Bulletin of the Mineralogical Society Of Southern California

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The 887th Meeting of the Mineralogical Society of Southern California

May11, 2012 7:30 pm

Geology Department, E-Building, Room 220 Pasadena City College 1570 E Colorado Blvd., Pasadena

In this issue:

Program: **On the Beauty of Defects: Color in Diamonds**

Eloise Gaillou, L A County Natural History Museum

Program 5/11/2012: Eloise Gaillou, Mineral Curator of the Los Angeles Natural History Museum will give a talk: On the Beauty of Defects: Color in Diamonds

Diamonds do not only come in "white" (or properly speaking: colorless), their color variety spans the full spectrum range: from brown (the most common color for diamonds), to black, to milky, to yellow, to the rarest green, orange, pink, purple, red and blue colors! The rarer the color, the more expensive the diamond. A "pure" diamond (which does not exist!) is made of a "perfect" cubic arrangement of carbon atoms and would be colorless. It is the presence of impurities that gives the rise to the highly desired colors. In this presentation Eloise will show which defect is associated with what color. She will also discuss the mysteries of some colors, such as the pink and brown, as well as the treatment of diamonds to give them attractive colors.

MEANDERINGS FROM THE PRESIDENT
by Ann Meister

As you all know, I've been asking for ideas for activities. Several have been sent to me recently and I'd like to explore a few of them. From Richard Horstmeyer I got a note suggesting, "How about a 2 day workshop on mineral identification, nomenclature, literature resources? Or a 2 day workshop on crystallography?" The question, of course, is how do we want to implement these activities?

One item we can immediately and easily begin is the exploration of literature resources. There are several immediate opportunities: a feature column in the Bulletin, show and tell and/or speakers at the meetings. Let's look at each of these.

Column in the Bulletin: This one is the hardest because I know it's nearly impossible to get anyone to commit to a regular feature in the Bulletin. However, a book or website review each month should not be too difficult. It doesn't need to be lengthy. It is as important to revisit old stand-bys as new publications or websites, but again, not all of us are as familiar with what is available. For this month, I've offered a few paragraphs on one of my "go-to" books when I'm looking for readable information on mineralogy.

Show & tell at the meetings: Do you have a favorite book on mineralogy, crystallography, geology, or related earth science? Bring it to a meeting and tell us why you like it, think it is important to have in your library, etc. We have members and visitors who are new to the hobby and science of our chosen avocation who may want to expand their knowledge, but not know which resource is best for beginners, or for special interests, or whatever. Many of us have extensive libraries or favorites that can easily be shared with others. Some of us "old-timers" are overlooking new web resources that are kept current and have chat rooms or Questions and Answer columns that are extremely useful.

Speakers at meetings: Here we need to coordinate with the Program Chairman (currently Bruce Carter). We need to ask our speakers to suggest further references on their presentation topic, perhaps even a printed list for those who are interested to follow-up. Also, we can get a speaker (perhaps from the Geo-Literary Society) who is knowledgeable of historical references in the geo-science world. Dona Dirlam, Director of the Research Library at the GIA comes to mind.

Does anyone else have suggestions for implementing this? Let's discuss it at the next meeting or contact me at president@mineralsocal.org. Thanks.

NEW FEATURE COLUMN!
GEO-LITERATURE RESOURCES

You can't find a better basic reference than Mineralogy by John Sinkankas. (Both paperback and hard back are out-of print but available used. The more expensive hard cover is Mineralogy for Amateurs). As other reviewers say, "If you are only going to own one mineralogy book, this needs to be it." It is comprehensive, covering just about everything from basic atomic structure and crystallography, to physical and optical properties. It has a great chapter on mineral formation and associations. John, who was one of my fellow freshmen at UCSD (but that's another story), was not a stodgy academician who wrote in high-falutin' convoluted prose. His writing is readable; he presents technical information with drawings and illustrations that help you understand the topic. I just discovered that a new version, updated by Joel Bartsch of the Houston Museum of Natural Science, is planned for this year.

MSSC BOARD MEETING MINUTES
April 13, 2012

The Board of Directors of the Mineralogical Society of Southern California met Friday, April 13, 2012 at Pasadena City College, Pasadena, CA. The meeting was brought to order at 6:15p.m. by Vice President Bruce Carter and turned over to President Ann Meister shortly thereafter.

The purpose of the meeting was to review and discuss changes and/or additions to the existing By-Laws. Various By-Laws items, including dues, Treasurer's duties, etc, were discussed, some changes made and all recorded by Directors Fred and Linda Elsnau. Board members will receive copies of those changes as soon as they become available.

An item for possible discussion at the next Board meeting is the Application for Membership form, which may need to be updated.

A suggestion was made by Jim Kusely that at the next Board meeting, the former Secretary Bob Griffis, be invited to attend, participate and provide suggestions, expertise and counsel regarding the By-Laws. There was agreement to his suggestion.

The meeting was adjourned at 7:25p.m.

Submitted by
Angie Guzman, Secretary

MSSC GENERAL MEETING MINUTES
April 13, 2012

The 886th meeting of the Mineralogical Society of Southern California was held on Friday, April 13, 2012 at Pasadena City College, Pasadena, CA. President Ann Meister brought the meeting to order at 7:35pm

The following business and announcements were made:

Minutes of the March 9, 2012 meeting were moved, seconded and approved;

Announcements:

Gene Reynolds's gold exhibits *Bower Museum*:
California gold: 2/15/12-9/9/12
Pre-Hispanic Art of Columbia: 3/31/12 – 7/1/12
Wayne Leicht: April 21, 2012, 1:30 PM -2:30 PM. World renowned collector and dealer of gold and mineral specimens, discusses the discovery of gold in 1849 and the beautiful gold specimens he has loaned to the Bowers currently on display in the California Gold exhibit. Hear the talk and then see the pieces for yourself!"

Gemological Institute of America (GIA): 4/21/12 all day symposium; topic is Topaz; cost $85 (corrected to actual amt.)

MSSC workshop discussion and suggestions: 2-day workshop on identification and naming; mineral cleaning; crystallography (possible use of PCC downstairs lab); how-to segment on micro-mounting. Also, Ann said she will meet with Tony (formerly of L a County Natural History Museum) to explore more topics.

Bruce Carter gave a hint of his recent trip to Morocco where the 2nd largest silver mine in the world is located. He indicated he may give MSSC a presentation later in the year.

Pat said there are no field trips anymore. [FLASH: After the meeting, Treasurer Jim conveyed that a new member is willing to chair the Field Trip committee!]

Video Broadcast Meetings was briefly mentioned as a possibility for MSSC in the future.

Program: Bruce Carter introduced the evening's presenter Paul Adams. Mr. Adams received his Bachelor's from New York and his Masters Degree from University of Southern California. Mr. Adams' interesting presentation focused on the Reward Mine and the Brown Mountain Mine and the many treasures within: Cerussite, Chrysocolla, Mimetite and Leadhillite crystals, to name a few. He provided quite a historical review of the Inyo County mines at the Manzanar Station near Lone Pine, California. Most spectacular, though, were the stunning photos of minerals and crystals he collected there. There were questions following the presentation, which Mr. Adams answered quite enthusiastically.

Door prize drawing was won by George Rossman.

Other Business: Bruce Carter made an announcement about the parking situation at PCC. Last meeting, several members got ticketed by the campus. Bruce kindly handed out a few pre-paid parking stubs before the meeting. Thanks, Bruce! The parking issue will be looked into.

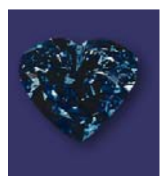
Adjourned 9:10pm
Refreshments.

Submitted by
Angie Guzman, Secretary

Splendor of Diamonds: These seven diamonds are among the most rare and valuable in the world. They are being displayed together for the first and only time through the collaborative efforts of the Smithsonian Institution, The Steinmetz Group, and the Gemological Institute of America. The Smithsonian National Museum of Natural History Exhibit 6/27 thro 9/30/2012
http://www.mnh.si.edu/exhibits

- *The De Beers Millennium* Star
- *The Moussaieff RedHope*
- *The Heart of Eternity*
- *The Steinmetz Pink.*
- *The Pumpkin Diamond*
- *The Ocean .*
- *The Allnatt*








Why is the Sandstone Red

Red Rock Country Sandstone can exhibit many colors, but landscapes of the American Southwest that exhibit such striking shades of red have been informally called "red rock country" (portions of which are also called "canyon country" where deeply incised canyons exist). The rock unit called the Navajo Sandstone features prominently in this landscape, and contains some of the largest and most abundant iron concretions found anywhere in the world. The Navajo Sandstone was named for the "Navajo country" of Arizona, Utah, and New Mexico. The red rock country on the Colorado Plateau where the Navajo Sandstone and other related rock formations are prominently exposed is centered around the Four Corners region where the states of Utah, New Mexico, Colorado, and Arizona meet. This story of the red rocks started millions of years ago. In the next section "Long Ago and Far Away," we address the following six questions.

1. Blood of the Living Rocks: What colors the sandstone red?
2. The Crimson Source: What is the origin of the red pigment?
3. Big-Time Bleaching: What happened to make some red sandstone turn white?
4. The Iron Baby: Where did the red pigment go, and what do iron concretions have to do with this?
5. The Light of Day: How were the sandstones exposed at the surface in the present landscape?
6. The Time Machine: When did all of this happen?

Long Ago and Far Away This story begins millions of years ago in a world and landscape very different from today: during the Jurassic Period (144-206 million years ago) when the North American continent was at a different latitude, and Utah was close to the equator in a belt of strong trade winds. These winds moved quartz sand to build dunes that covered an area bigger than the Sahara Desert. An accumulation of desert sand dunes is called an erg or sea. The largest erg to ever exist in North America is preserved in the Jurassic-age Navajo Sandstone (approximately 180-190 million years old) that is up to 2,500 feet (750+ m) thick. The Navajo Sandstone was deposited over a broad area of the Colorado Plateau and is now well exposed in national parks and monuments such as Zion, Capitol Reef, Arches, Canyonlands, Grand Staircase-Escalante, and a number of surrounding areas. Other rock formations such as the Wingate Sandstone and Entrada Sandstone (see figure of Jurassic units) are also ancient sand dune deposits that show similar coloration and iron concretions. However, the Navajo Sandstone is the focus of this booklet because it displays such a wide range of color (from white to many shades of red) and contains some of the greatest variety of iron concretions found anywhere in the world.

1. Blood of the Living Rocks What colors the sandstone red? The red color is caused by a union of iron and oxygen (an iron oxide) known as hematite (Fe_2O_3), a mineral named from the Greek word for blood. Iron is a powerful pigment present in many sediments and rocks, thus it commonly imparts color to the rocks.

Although red is the common pigment color, not all iron oxides are red; some are brown or yellow (minerals - limonite or goethite), and some are black (mineral - magnetite). Some iron minerals are metallic yellow (mineral - pyrite consisting of iron sulfide) or green (minerals - chlorite or clay consisting of iron silicate). Although geologists have long understood that sandstone coloration is a function of varying amounts of iron, it is only recently that scientific studies (partly presented here) detail how this happens.

2. The Crimson Source What is the origin of the red pigment in sandstone? The origin of the color is due to a chemical reaction similar to rusting of a nail. An iron nail appears silver in color and metallic. When a nail rusts due to the addition of water molecules and oxygen, two or three iron electrons are lost to oxygen (the iron is oxidized). The remaining electrons, together with the oxygen, absorb all of light’s colors except red and brown. But iron nails don't color sandstones red.

Sandstone originates from the breakdown of older rocks, a process called weathering. Granite, for example, is a type of igneous rock that commonly breaks down in weathering to produce sand grains that later make up sandstone. The older “parent” rocks often have minerals that contain some iron, but these minerals are green or dark brown. Water in contact with the atmosphere absorbs oxygen. Dissolved oxygen in water is very aggressive in removing electrons from iron to produce rust (oxidized iron). As the iron-bearing minerals weather and react with oxygen and water from the atmosphere, the iron is released and forms very thin, paint-like coatings of hematite on the quartz sand grains. Iron in hematite that has lost three electrons absorbs most of the visible colors of light and only red is transmitted to produce the mineral’s red coloration. Sands deposited in deserts gradually redden as iron minerals break down and lend their red coloration to the sand. The reddening continues after burial as more overlying sedimentary units are added. Over millions of years, these loose sand grains are compressed and cemented into the rock called sandstone. In these red sandstones, microscopic, oxidized iron films of the mineral hematite spread and coat the quartz grains. The amount of hematite is very small, but since iron is a powerful pigment a little red goes a long way!

3. Big-Time Bleaching What happened to make normally red sandstone white? Sandstone is porous and permeable because there are holes or spaces between sand grains. Sand dunes make particularly permeable sandstone because wind effectively sorts the grains to create a homogeneous deposit with uniform grain size and not much fine-grained pore fillings. Given enough pressure and force, water moves relatively easily through porous sandstone almost like water through a sponge. Even during heavy rains with much surface runoff, some water infiltrates the sandstone. Under certain conditions, iron pigment will dissolve in water and be removed, or be rendered colorless by chemical reactions with the water. This is much like a bleaching detergent permeating a red cloth, removing color as it spreads. (However, household chlorine bleach won’t take out iron rust stains because chlorine is not chemically able to move iron).

How does bleaching happen chemically? Some waters contain reducing agents (electrons are added to the iron atom and oxygen is removed) that make the iron soluble (dissolvable) in water. To make iron soluble, the water can restore one of the electrons that was lost by iron during early weathering and oxidation. Fluids such as hydrocarbons (petroleum), weak acids (vinegar-like), or those with hydrogen sulfide (gas that smells like rotten eggs) can also restore an electron to iron, thus these are called reducing waters. This water can dissolve and remove nearly all of the hematite and bleach red sandstone to white.

4. The Iron Baby After bleaching, (A) where did the red pigment go, and (B) what do sandstone marbles have to do with this?

(A) The red pigment is essentially “dissolved” but still carried by reducing water. So the iron that was bleached out of the sandstone is “held” by the reducing water. On a chemical level, critical changes may occur in the water that has dissolved the iron pigment.

(B) Once the reducing water carrying the dissolved iron meets and mixes with oxygenated water, the oxygen immediately removes an electron from the dissolved iron and drastically reduces its solubility. Thus, a new iron mineral, hematite containing fully oxidized iron, is immediately precipitated in the spaces between the grains of the sandstone to form the iron concretions. This is like a marriage where opposites attract and the end product is a new “baby”; the mixing of water causes new iron minerals to grow or precipitate.

Now, instead of thin iron coatings on the sand grains, the iron is concentrated as a thick hematite cement, like a glue, that surrounds the quartz sand grains. Thus, the most abundant iron concretions are typically found in areas where the sandstone is bleached, most likely because the iron for the concretions is actually some of the same iron that formerly made the sandstone red.

Precipitated iron can cement sandstone into many different sizes and shapes of concretions. Pea- to marble- to baseball-sized iron concretions are some of the most forms, but buttons, columns, pipes, towers, and even corrugated sheets or layers are some of the other shapes that can form. The precipitated hematite can be so concentrated that it looks black in reflected light, but it is still red in transmitted light when viewed under a microscope.

We don't know why some iron concretions are so round, but perhaps some "seed" or nucleus alters local chemistry to precipitate iron in a uniform (spherical) manner. In the concretions, the nucleus could be organic matter or other material that enhances chemical reactions and precipitation. Precipitation is most easily accomplished when some nucleus is present. However, if no nucleus is present, then there may be some optimum physical spacing of concretions that grow by drawing and pulling in their chemical components for precipitation from a local vicinity. Thus, when reducing water carrying soluble iron meets with oxidizing water, the concentrated hematite may precipitate in spaced-out spherical concretions.

All of this iron dissolution and transportation takes place underground. Even mixing with oxygenated water is a subsurface process. The precipitation of the iron in concretions takes place hundreds of feet or more below ground.

The ancient dune sandstones, because of their porosity and permeability, are a good medium for transmitting fluids. Water transport can also be facilitated along weaknesses and cracks in the rock (like faults and joints).

Over the long history of these rocks, enormous amounts water have flushed through this porous sandstone. The formation of one golf-ball-sized iron concretion requires many times its volume of water.

5. The Light of Day How was the sandstone exposed in the present landscape? Originally, much of the sandstone was deposited as sand dunes in a desert 180 million years ago. Other rocks about the same age were deposited near the ocean when this region was near sea level. Why is the area now at considerable elevation above sea level and what processes or events led to its present elevation? Strong forces responsible for uplifting buried rocks are commonly attributed to the interactions between large outer pieces of the Earth's crust; a field of study called plate tectonics. Interaction of the Pacific plate (beneath the Pacific Ocean) and the North American plate (largely the continent of North America) thickened the crust and uplifted the Colorado Plateau 80 to 50 million years ago. Uplifted rocks were gradually removed by weathering and erosion, exposing the formerly buried rocks.

More uplift related to rising magma (molten rock) occurred on the Colorado Plateau about 25 million years ago (Ritter and Smith, 1996; Wendlandt and others, 1996). Igneous rocks resulting from the rising magma form prominent landmarks such as the La Sal Mountains, Abajo Mountains, and the Henry Mountains in Utah; the San Francisco Mountains in Arizona; and Shiprock in New Mexico.

During these episodes of uplift, and later during accelerated erosion beginning about 6 million years ago (Hunt, 1969; Lucchitta, 1979), the sandstone formations have been carved and sculpted by flowing water and river systems, including the Colorado River and its tributaries. Weathering and erosion have helped further expose sandstone cliffs over the past several million years

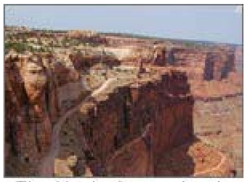
Continued uplift and river cutting help to create the canyon country of the Colorado Plateau. The hard, spherical iron concretions are more resistant to weathering than the lightly cemented sand grains of the surrounding or encasing rock. Discrete, individual concretions, that are now loose like marbles, became concentrated on the surface because all the surrounding rock weathered away over a long period of time.

6. The Time Machine How far back in time must we travel to see all of this happen? The sand dunes first piled up in the Jurassic deserts some 180 million years ago. The sands were red when they accumulated, and reddening continued for tens of millions of years during burial, compaction and cementation to form rock. The bleaching of sandstones probably occurred between 65 and 25 million years ago. The precipitation of iron concretions occurred after bleaching, likely between 25 and 6 million years ago.

We can apply basic principles of geology to deduce the relative time of bleaching. Regional rock colors follow the original layered patterns and have been later cut by rivers, to suggest that bleaching occurred before river erosion. However, some bleaching likely occurred after the formation of faults that provided easy pathways for fluid movement and localized bleaching along the faults and other fractures in the rocks.

A variety of scientific methods can be used to deduce the age of events in millions of years. Specific ages of rocks can be determined from the constant decay of radioactive elements in the rock minerals. A clay mineral called illite occurs along the faults that act as major conduits for fluid movement and bleaching of sandstones. The illite contains potassium, and thus its age can also be estimated. Potassium and argon age analysis of illite from the Moab fault (northwest of Moab, Utah) suggests that bleaching occurred as early as 50 million years ago when the fault developed, well before the time of the iron concretion precipitation.

Radiometric dating of minerals associated with iron concretions can help tell us when 12 the minerals were precipitated. Measurements of potassium and argon in associated manganese minerals (Chan and others, 2001) yield ages of 25 to 20 million years, and suggest a similar timing for some of the iron precipitation. Paleomagnetic dating is a technique that relies on the memory that rocks have for the Earth’s magnetic field. Iron minerals in rock act like a magnet and align themselves with the Earth’s magnetic field, and the magnetic field has switched poles throughout geologic time. Measurement of the magnetism that remains in the rocks can indicate when they were deposited, and magnetism that remains in bleached rocks is an indication of the time of bleaching. Magnetic measurements (R. Garden, written communication, 2000) suggest the iron reduction and bleaching happened 65 million years ago or less



The Neck, Canyonlands
© Dave Webb

Buck Canyon Overlook
© Pam Burt

Green River Overlook
© Dave Webb

See entire paper including picture at http://geology.utah gov /online/pdf/pi-77.pdf
Public Information Series 77, Utah Geological Survey *a division of* Department of Natural Resources
Rainbow of Rocks Mysteries of Sandstone Colors and Concretions in Colorado Plateau Canyon Country by Marjorie A. Chan and William T. Parry Dept. of Geology and Geophysics 135 S. 1460 E. - University of Utah Salt Lake City, UT 84112-0111
Photos are from www.utah.com/national parks

Calendar of Events

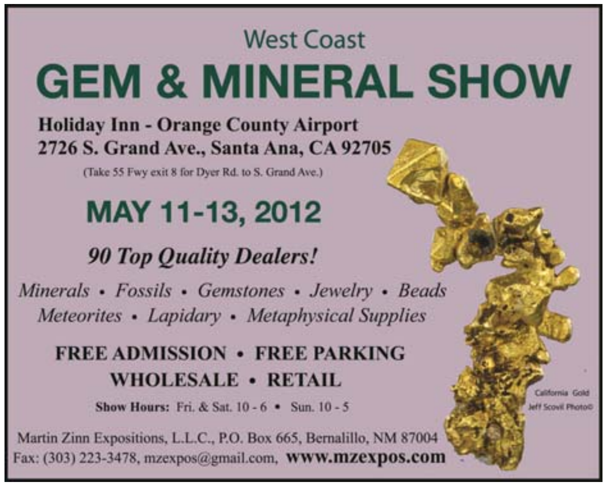
May 5 - 6: ANAHEIM, CA, Searchers Gem & Mineral Society, Brookhurst Community Center, 2271 W. Crescent Avenue, Hours: Sat. 10 - 5; Sun 10 - 4:30

May 11-13: **SANTA ANA, CALIFORNIA**: Spring West Coast Gem & Mineral Show; Martin Zinn Expositions; Holiday Inn - Orange County Airport; 2726 S. Grand Ave.; Fri. 10-6, Sat. 10-6, Sun. 10-5; free admission

May 19-20: YUCAIPA, CALIFORNIA:; Yucaipa Valley Gem & Mineral Society; Yucaipa Community Center; 34900 Oak Glen Rd.; Sat. 9-5; free admission

June 30 - July 1: CULVER CITY, CA, Culver City Rock & Mineral Club, Culver City Veterians Memorial Auditorium, 4117 Overland Avenue (Overland & Culver), Hours: Sat 10 - 6; Sun 10 - 5

July 13-15, 2012 Riverside, CA 2012 CFMS Gold and Gem Show & Convention., Municipal Auditorium, 3485 Mission Inn Avenue, Riverside, CA. 10:00-4:00 each day



MSSC Advertisement Policy

Mineral-related ads have always been acceptable in the bulletin. Below is the price per month

Business card size	**$5**	**1/3 Page**	**$10**
1/2 Page	**$20**	**Full Page**	**$35**

In addition, any advertiser who purchases 12 months of space in advance will receive a discount of 12 months for the price of 10 months. The copy for the ads should be e-mailed to the editor at bulletin@mineralsocal.org and the payment should be sent to the MSSC Treasurer at 1855 Idlewood Road, Glendale, CA 91202-1053. The Bulletin Editor reserves the right to decline requests for space if material submitted is judged to be inappropriate

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2012 PACIFIC MICROMOUNT CONFERENCE COMMITTEE

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Speakers	Bob Housley
Pre-registration	Bob Housley
Electrical	Alan Wilkins
Sales Table	Garth Bricker
Give-away Table	Gene Reynolds
Food	Ann Meister, Sugar White

About the Mineralogical Society of Southern California

- Organized in 1931, the Mineralogical Society of Southern California, Inc. is the oldest mineralogical society in the western United States. The MSSC is a member of the California Federation of Mineralogical Societies, and is dedicated to the dissemination of general knowledge of the mineralogical and related earth sciences through the study and collecting of mineral specimens. The MSSC is a scientific non-profit organization that actively supports the geology department at Pasadena City College, Pasadena, California. Support is also given to the Los Angeles and San Bernardino County Museums of Natural History. The Bulletin of the Mineralogical Society of Southern California is the official publication of the Mineralogical Society of Southern California, Inc.
- The MSSC meetings are usually held the second Friday of each month, January, February and August excepted, at 7:30 p.m. in Building E, Room 220, Pasadena City College, 1570 E Colorado Boulevard, Pasadena, California. The annual Installation Banquet is held in January, and the annual Picnic and Swap Meeting is held in August Due to PCC holidays, meetings may vary. Check the Society website for details. The Society also sponsors the annual Pacific Micromount Symposium held at the San Bernardino County Natural History Museum during the last weekend of January.
- Annual Membership dues for the MSSC are $20.00 for an individual membership, $30.00 for a family membership.
- The Society's contact information: **Mineralogical Society of Southern California 1855 Idlewood Rd., Glendale, CA 91202-1053 E-mail: bgbrdpen@earthlink.net Web: http//:wwwmineralsocal.org The Mineralogical Society of California, Inc.**
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