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The 840th Meeting of The Mineralogical Society
of Southern California

Minerals and Metals in the Salton Trough
by
Dr. Michael McKibben

Friday, February 22, 2008, at 7:30 p.m.

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

Featuring:

--Hydrothermal Minerals and Metals in the Salton Trough
--**Barioperovskite, a new mineral**
--Change of guard
--Purple opal

February Meeting
Hydrothermal Minerals and Metals in the Salton Trough

Attention!!!
This meeting is on the 4th Friday of February!

Dr. Michael McKibben will speak on *Hydrothermal Minerals and Metals in the Salton Trough* at 7:30 p.m. on Friday, February 22, 2008, in the Geology Department of Pasadena City College (Room E220). The Salton Trough contains a variety of hydrothermal mineral deposits, including Mesozoic gold related to arc plutonism, Oligocene and younger epithermal gold related to rift fault systems, and active base metal mineralization produced by the modern geothermal brines in host sediments and wellbores. Examples of these mineral deposits will be highlighted along with their implications for the origins of certain types of ancient ore deposits found throughout the world. Samples of recent Cu-Pb-Zn-As-Au-U

Drillcore with open fracture lined by Cu-Fe sulfides and oxides from the Salton Trough.


Galena-sphalerite scales from geothermal wellhead. Field of view is 9 cm wide.

mineral precipitates from the Salton Sea sediments, wellbores and power plants will be available for examination.

Prof. Michael A. McKibben (http://mckibben.ucr.edu) specializes in geochemistry and economic geology at UCR and has published extensively on the Salton Sea and other hydrothermal systems. His current research focuses on the kinetics of dissolution of minerals containing As, base metals and W and their relevance to environmental contamination of natural waters. He is a Life Fellow of the Society of Economic Geologists.

Minutes of the January 12, 2008 Meeting

The 839th meeting of the Mineralogical Society of Southern California was held on Saturday, January 12, 2008 at The Oak Tree Room, Arcadia, CA.

The meeting was brought to order at 6:30 p.m. by Ilia Lyles, and dinner was promptly announced.

Immediately following the dinner, Janet Gordon introduced the speaker of the evening, Wayne Leicht. Wayne and Dona Leicht, who are premier mineral dealers, founded their company, Kristalle, in 1971. They offer the finest mineral and gold specimens, and have been strong supporters of the MSSC for many years.

Mr. Leicht gave a two-part presentation. He began by describing his collection efforts in Venezuela, principally in the Santa Elena district. There are diamond mines in the area, but the acquisition of crystallized wire gold was the goal of the trip.

The efforts involved in even reaching the Santa Elena district, let alone purchasing and shipping specimens, and laying the groundwork for the establishment of a mine, were considerable. The negotiations with the local Indian chief for mine operating rights, in exchange for a jeep and a generator, were particularly interesting (Venezuelan government approval is still needed). Also notable was the sophistication of the locals regarding the values of their respective specimens, despite being isolated geographically.

Next, Mr. Leicht discussed the purchase and subsequent dispersal of the mineral and gem collection from the Academy of Natural Science in Philadelphia. Although there were thousands of specimens available for purchase, others could not be sold due to restrictions placed on the specimens at the time of donation. Sadly, 6 to 8 tons of materials had to be disposed of due to deterioration during long storage periods.

The Academy of Natural Science sold the specimens as interest at the Academy had shifted from minerals to the life sciences, and funds were required for operating costs.

The gems in the collection, including tourmalines, sapphires, emeralds and other beryls, were particularly striking, as shown in the slides prepared by Mr. Leicht. When possible, such gems were sold to museums and other institutions with ties to the specimens.

A large part of the collection is now being catalogued and stored in Colorado.

Following the talk, two new officers were presented: Geoff Caplette, President, and Herman Ruvalcaba, Treasurer. Janet Gordon will continue as Vice President, Pat Caplette will remain Secretary, and Jo Anna Ritchey will still serve as

Director. Past presidents were also acknowledged and thanked for their service.

All of the items at the silent auction, which was held during the meeting, were sold. The amount of the proceeds will be announced at the next meeting.

President Geoff Caplette brought the meeting to a close at 9:00 p.m.

Respectfully submitted, Pat Caplette Secretary

Change of guard. New president Geoff Caplette to the right and former president Ilia Lyles. Photo by Shou-Lin Lee

Attention!
A board meeting will follow the regular meeting on February 22, 2008.

Barioperovskite, a new mineral from the Benitoite Mine, San Benito County, California

By George R. Rossman

For more than 40 years, the Caltech electron microprobe laboratory used a disk of brass made and sold by Materials Analysis Corporation that contains dozens of standard materials representing the common elements and most of the uncommon elements on the periodic table. The standards were all mounted in the brass with pressed copper powder and polished flat, flush with the brass. In the center of this standard collection is a piece of benitoite ($BaTiSi_3O_9$) that can be used as a chemical standard, or, more commonly, as a fluorescent compound that glows when struck by the electron beam and allows the operator to align the beam in the instrument. Many times a week for the past 40 years, this polished piece of benitoite was used in the lab by what now amounts to many hundreds of people.

We have always avoided three spots on the benitoite standard where small, circular pits exist (Fig. 1). During testing of a new electron microprobe obtained about two years ago, curiosity led our head analyst, Chi Ma, to take a closer look at the small circular pits in the benitoite standard. They were initially examined with the electron microprobe and with a scanning electron microscope. During this examination, he noticed that the pits were actually tubular inclusions within the benitoite. A total of four tubular inclusions were found in our crystal and three of them had been opened during the preparation of the benitoite standard.

Close examination of the exposed tubes showed that there is a cylindrical rind between the opening and the host benitoite that appeared different in reflected light (Fig. 2). Within this rind, obvious differences in the reflection can be seen that suggest that additional phases are within the rind. The rind can be clearly seen in the electron microscope

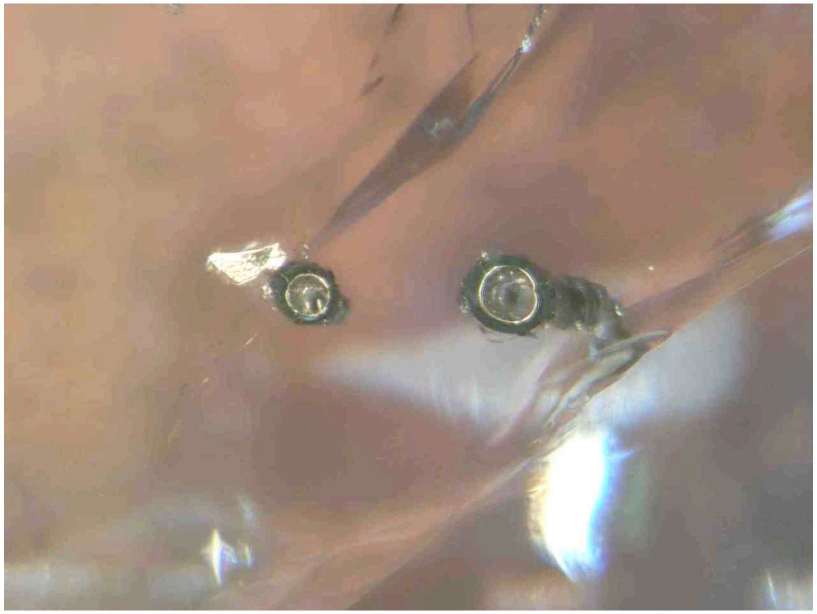

Figure 1. Two of the three pits exposed on the polished surface of the benitoite electron microprobe standard. The total width of the pit and the dark area surrounding it is close to 0.1 mm. Stacked images using Helicon Focus software provides the depth of focus.

images. These differences showed up even better in the electron microscope when back-scattered electrons were used to obtain the image. The efficiency of return of back-scattered electrons depends on the average atomic number of the sample. In this case, the brighter reflections indicate that the average atomic number of the crystals in the area surrounding the tube is greater than benitoite and that they are a different phase.

The chemical analysis of the bright regions was obtained with the electron microprobe. This instrument can focus the electron beam to less than 0.001 mm and can analyze an area on the order of a micrometer. The formula of the brightest regions near the bottom of Figure 2 corresponded closely to $BaTiO_3$. No mineral on the IMA list had this formula, indicating that this phase was a new mineral. The formula is similar to that of perovskite ($CaTiO_3$), but with barium, rather than calcium.

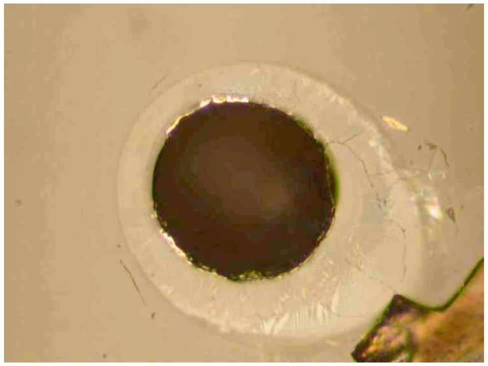

Figure 2. Reflected light microscope photograph of an inclusion in benitoite showing the higher reflectivity of micro crystals near the 60 micrometer wide tube that are contained in a cylindrical rind between the tube (black) and the benitoite (uniform color).

To get a new mineral approved by the International Mineralogical Association (IMA), typically both chemical analysis and an X-ray powder pattern (or a complete X-ray structural determination) are required. Chemical formulas, alone, can not establish the structure of the phase. This is why the X-ray pattern is normally required to characterize a new phase.

Unfortunately, the grains of the new phase are too small for X-ray studies, and would be much too difficult to separate from the surrounding material. Fortunately, another technique involving electron diffraction can provide a related diffraction pattern in a scanning electron microscope under very high magnification conditions. It is known as electron back-scattered diffraction (EBSD). The EBSD pattern of the new mineral is shown in Figure 3. It allows diffraction patterns to be obtained on areas much less than 1 by 1 micrometer in size.

Much like a conventional X-ray powder pattern, the EBSD pattern needs to be compared to a library of standard patterns of known minerals. Because this phase represents a new mineral, no standard pattern exists. Fortunately, $BaTiO_3$

is well known as a synthetic material and has been well-studied in the materials-science literature. It exists in several polymorphs, all of which have been structurally characterized. From the X-ray structures of these polymorphs, it is possible to compute what the EBSD pattern will be for each polymorph.

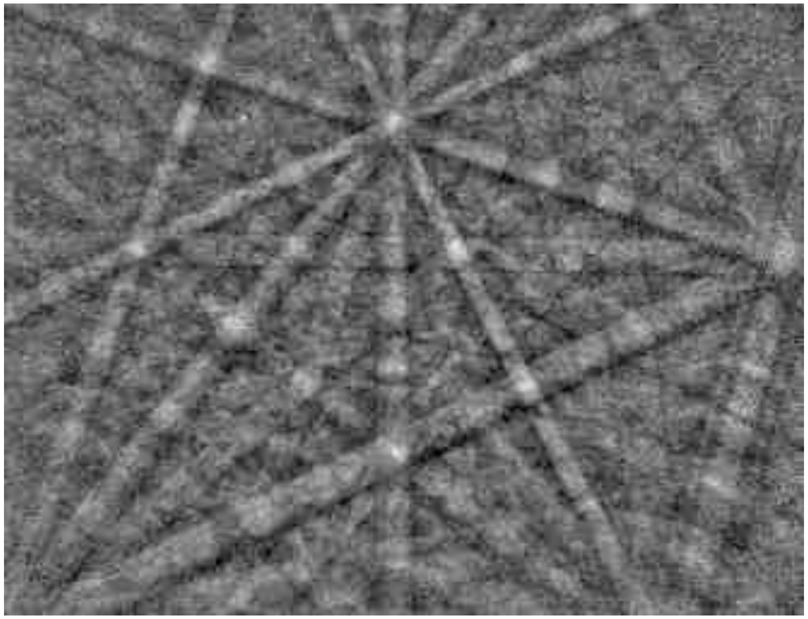

Figure 3. Electron Back-Scattered Diffraction pattern of $BaTiO_3$.

Barioperovskite, $BaTiO_3$ is a member of the perovskite group of compounds but it has a structure (*Amm2*) which is slightly different from the structure of the mineral perovskite (*Pnma*). If the structures were the same, barioperovskite would be probably be named perovskite-(Ba) according to proposed new systematic nomenclature guidelines. But, because the structure is different, the name, barioperovskite, can be used. Raman spectra were also obtained on the barioperovskite that confirmed that it is different from any previously known barium titanate or barium titanosilicate mineral, and that it has a structure in the perovskite family of compounds.

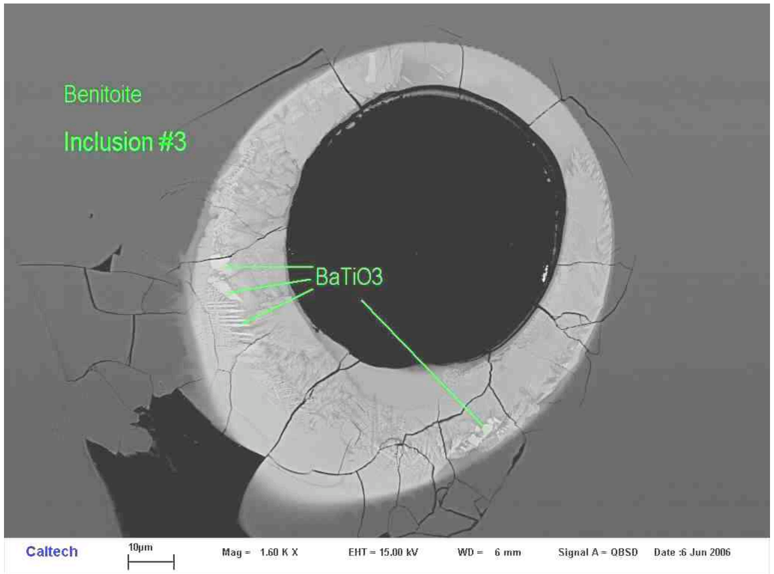

Figure 4. Scanning electron microscope image taken with back-scattered electrons that clearly shows the barioperovskite crystals in the rind that surrounds the hollow, tubular inclusions in benitoite. The scale bar at the bottom of the image is 10 micrometers.

Significant amounts of fresnoite ($Ba_2TiSi_2O_8$) micro crystals were also located in the rind that surrounds the hollow, tubular inclusions. They are found to the right and left of the two larger crystals of barioperovskite in Figure 4.

To date, this is the only known barioperovskite. Dozens of crystals of benitoite and gemstones were examined for hollow, tubular inclusions that may host other crystals of barioperovskite, but none have been found at this time. It is possible, even likely, that the hollow tube was formerly a fluid inclusion that ultimately coagulated as a gel from which the barioperovskite ultimately crystallized. This discovery has been recently published in American Mineralogist by Chi Ma and George R. Rossman (2008) volume 93, pages 154-157. A picture of barioperovskite can also be seen on www.mindat.org

My New Finds from Quartzsite

Photos and text by Shou-Lin lee

The vendor had a sign that said "Purple Opal." Since I am an opalholic who has a weakness for purple stones, despite the visible fractures criss-crossing the stones, I purchased a handful. As usual, I asked where the stone was from. The vendor considered that a trade secret and told me only that they were from central Mexico, where he also found Tiffany Stone/bertrandite.

"And what are these?" Though the sign said opal, I still had to ask. "Morado opal" is the answer I got. As I asked him to write the name down, he told me that morado simply meant purple in Spanish. I thought he was just having fun with me.

When I proudly showed these off to Dr. Rossman, he thought the purple part was likely agatized amethyst. My experience in cutting these: fairly soft, can be scratched by a knife and too many fractures.

Passing of a Member

Email from Tony Kampf: Mel Hindin passed away on December 19 after a lengthy battle with heart problems. Mel was a member of MSSC and a long-time supporter of the Natural History Museum and of its

Mineral Sciences Department, in particular. He started as a touring docent in the 1980s and particularly enjoyed giving tours of the Hall of Gems and Minerals. In 1994 he joined the Board of Directors of the Museum Gem & Mineral Council, on which he served until his death. Mel was also a member of the Museum Alliance Board of Directors and, with his wife Lois, was a member of the Museum Fellows. His numerous gifts of fine mineral and gem specimens greatly enhanced the Museum collections. His generosity, good humor and friendship will be missed by all.

2008 Calendar of Events

February 15-24, 2008, Indio, CA San Gorgonio Mineral & Gem Society Riverside County Fair & National Date Festival Gem & Mineral Building Bldg #1 46-350 Arabia Street Hours: 10 am - 10 pm.

February 22-23, 2008, Northridge, CA Delair Rockhounds, United Methodist Church, 9650 Reseda Blvd. (at Superior St.) Hours: Fri. 3 p.m. - 9:30 p.m., Sat. 10 a.m. - 5 p.m.

February 29 - March 1-2 2008, Hayward, CA Mineral & Gem Society of Castro Valley, Centennial Hall,. 22292 Foothill Blvd. Hours: Fri. and Sat. 10 - 6, Sun. 10-5

February 29 - March 1-9 2008, Imperial, CA Imperial Valley Gem & Mineral Society Imperial Valley Fairgrounds 2 nd St. & Hwy 86 Hours: Mon-Fri 4-1, Sat-Sun 12-11

March 1-2 2008, Arcadia, CA Monrovia Rockhounds, Los Angeles County Arboretum & Botanical Garden, 301 N. Baldwin Ave. Hours: 9 - 4:30 both days

March 1-2 2008, Escondido, CA Palomar Gem & Mineral Club, Army National Guard Armory, 304 Park Avenue Escondido, CA Hours: Saturday 9-5, Sunday 9-4

March 1-2 2008, Ventura, CA Ventura Gem & Mineral Society Seaside Park - Ventura County Fairgrounds 10 W. Harbor Blvd. Hours: Sat. 10-5, Sun. 10-4. The show is free. Kids will enjoy making fossils, grabbags, and a variety of other kids' activities. There will also be demonstrations of lapidary arts and exhibits from wonderful private collections of rocks, minerals, fossils, and lapidary work. Raffle prizes will be drawn at the end of the show, and a silent rock auction will be held continuously throughout the show. Fifteen dealers in fossils, minerals, lapidary equipment, slabs, etc., will be on hand, along with a country store featuring flea market items, used books and magazines and plants.