



Arizona Geological Society Newsletter

SEPTEMBER 2015

September 1, 2015 DINNER MEETING

Who: Carl Bowser will speak about “The Genesis of the Kramer Borax Deposit, Rogers Lake, Mojave Desert, CA: A 50 Year Retrospective”

Where: Sheraton Tucson Hotel and Suites, 5151 East Grant Road, (at the intersection of Grant and Rosemont on the North side of Grant in the *PIMA BALLROOM* (enter at northwest corner of the building) and go upstairs to the meeting room.

When: Cash Bar at 6 p.m.—Dinner at 7 p.m.—Talk at 8 p.m.

Cost: Members \$27, Guests \$30, Students Members free with on-line reservation (\$10 without).

RESERVATIONS ARE REQUIRED: Reserve on the AGS website (www.arizonageologicalsoc.org) by **11 a.m. Friday, August 28th**. Please indicate regular (Grilled Chicken Breast with a sundried tomato & thyme cream sauce), vegetarian, or Cobb salad meal preference. Please cancel by Friday, August 28th at 11 a.m. if you are unable to attend - no shows and late cancellations will be invoiced.



The AGS is Grateful for Our Sponsors, Who Help Us to Offset Dinner Meeting Costs

The Genesis of the Kramer Borax Deposit, Rogers Lake, Mojave Desert, CA: A 50 Year Retrospective

by Carl Bowser

Borax serves a broad spectrum of industrial uses ranging from glazes, detergents, borosilicate glasses, fire suppressants, and agricultural medical products. Its history and use goes back several millennia, yet it wasn't until the year 1294 that borax became known to the “Western World” through the travels of Marco Polo. Chemically boron has charge/radius properties allowing it to exist in three and four fold coordination with oxygen allowing it to substitute in silicon and aluminum coordinated minerals. Boron bearing minerals are numerous and form over a large range of geologic conditions.

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ABSTRACT - Continued from Page 1

Industrial boron is largely derived from sedimentary, non-marine evaporite deposits that are primarily Tertiary age or younger. In the US boron producing localities are generally restricted to the Cordilleran basin and range province, including Death Valley, Searles Lake, and Borax Lake. Significant other deposits are found in South America, Turkey, Italy, and Tibet. Deposits in Death Valley have been exploited since 1882, but these ulexite and colemanite dominated deposits were costlier to process than pure borax. The Kramer borax deposit was discovered in 1925, and its size and purity led to its being the primary source of boron for most of the world through the late 20th century. In more recent years significant deposits in Turkey and South America (Peru, Chile, Bolivia) have overtaken the world market, with Turkey's deposits being the principal source in recent years.

A comparison of non-marine deposits in Turkey and South America reveal nearly identical patterns of deposition, mineralogy, and links to geothermal systems. Argued to have formed in shallow, meromictic lakes the borax textures and depositional sequence require sub-aqueous deposition in the absence of other typical evaporite minerals, putting severe restrictions on the range of compositions of the evaporating fluids. The deposits are characterized by being chemically zoned, as nested envelopes of sodium, sodium-calcium and calcium borates. Invariably a core of pure borax sediments are surrounded both laterally and vertically by a sodium-calcium borate facies, principally ulexite, and an outer envelope containing inyoite, meyerhofferite, and colemanite, the calcium borate facies.

Post depositional thermal alteration has generated a number of secondary borates in veins cross-cutting the ores and replacing earlier-formed, primary phases. Silicate and borate diagenesis in volcanic tuffs and claystones within the deposits are common. Development of Kernite and the existence of hydrothermal sulfide minerals such as realgar, orpiment, and stibnite belie links of the borate deposits to nearby thermal springs. More recent work using boron isotopic systems shed light on these processes, but the use of these and other isotopic systems has yet to be fully exploited.

The talk will focus on the Kramer deposit, but comparisons among major deposits in South American and Turkey will serve to highlight the common processes that formed these deposits, and some of the remaining questions on the origin of these unusual deposits.

About the September Dinner Speaker



Carl was born and raised in the Los Angeles area, a third generation native Californian. He got his undergraduate degree in geology at UC Riverside, 1959, and his Ph.D. in geology/geochemistry at UCLA in 1964 under the tutelage of F.W. Dickson and George Tunell. He accepted a position in the Geology Department at the University of Wisconsin, where he moved in January of 1964. His teaching career spanned nearly 37 years until his retirement in 2000. During his career he dedicated his research to interdisciplinary studies with colleagues in Water Chemistry, Soils, and Limnology and the Water Resources Division of the USGS. He chaired the Oceanography and Limnology Graduate program at UW for four years and was a lead principal investigator with the NSF-LTER project (Long Term Ecological Research) for the last 20 of his years at Wisconsin.

Broadly interested in mineral-water interaction and the geochemical controls on the chemistry of natural waters, his research work focused on non-marine evaporites,

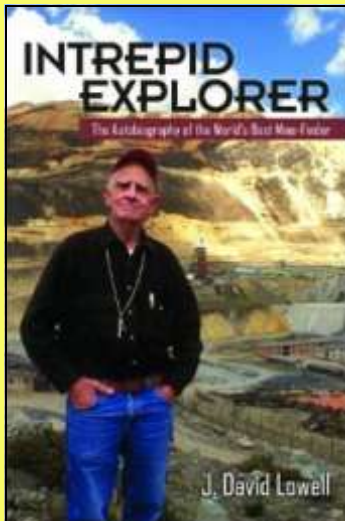
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Bio - continued from page 2

fresh water and marine ferromanganese nodules, the mineralogy of lake sediments, and studies of lake-groundwater systems using stable isotope and major ion systems. Research has taken him over the world including: Antarctica (two field seasons), dry lakes in the basin and range province including the Kramer borax deposit, Columbus and Teels Marsh, NV, the Great Salt Lake, UT, the eastern Pacific manganese nodule belt, freshwater nodules in Green Bay and upper Wisconsin lakes, saline thermal brines in the Red Sea, taconite waste disposal into Lake Superior and ephemeral, shallow playa lakes in the Jornada del Muerto area, NM.

Over his time at Wisconsin he worked extensively with UW colleagues at the Center for Limnology, and USGS colleagues in the Reston office, principally Blair Jones, Ted Callender, T.C. Winter (Denver), R. Marzolf, M.J. Baedecker, and Carol Kendall (Menlo Park). The USGS has literally been his second home. Two sabbaticals in the Denver and Boulder USGS offices led to work on the Colorado River flood experiment in 1996 (R.Marzolf), and lake groundwater interactions in the Cottonwood Lake area, NE (T.C. Winter). For the four years immediately following his retirement he continued to complete research publication in the geosciences, while at the same time renewing a love for an old friend, the camera.

He joined photographers at the Center for Photography at Madison (now PhotoMidwest) where he served ten years on the board of directors, and two years as president. Workshop participation, visiting artists and travel to the western states exposed him to a large group of talented photographers, including some of the leading photographers of our time. Travel to Santa Fe and Abiquiu, New Mexico, and Big Sur for workshops helped develop his photographic skills. He has exhibited extensively at shows and local establishments in the Madison area. His northern Wisconsin work was exhibited in a small gallery in Boulder Junction. Western landscapes, glacial lakes, and human interest photography dominate his work.



Intrepid Explorer: The Autobiography of the World's Best Mine Finder

David Lowell has agreed to attend the September 1, 2015 meeting to sell/sign books. A representative from the University of Arizona Press (the publisher) will be there with books to purchase.

A native Arizonan, whose family roots date from territorial days, J. David Lowell was raised on a ranch near Nogales, Arizona to become one of the world's most successful exploration geologists. He received a B.S. degree in Mining Engineering from the University of Arizona in 1949 and a M.S. degree in Geology from Stanford in 1957.

He has personally discovered more copper than anyone in history, contributing to the discoveries of the Kalamazoo, Vekol Hills and Casa Grande West deposits in Arizona, the J A. Deposit in British Columbia, the Dizon and Far Southeast deposits in the Philippines, and the La Escondida, Zaldivar-Escondida Norte and Leonore deposits in Chile. He is also personally responsible for the discovery of the San Cristobal Au-Ag mine in Chile and the 8-million ounce Pierina gold deposit in Peru.

Dave Lowell has published more than 50 articles, including one of which he co-authored with John Guilbert in 1970 that defines the Lowell-Guilbert porphyry copper model. This work remains a standard reference for exploration geologists, today.

I encourage everyone to come out and meet David Lowell and purchase a copy of his book. It's a fun read if you have not read it already.



2015 ANNUAL SYMPOSIUM
September 16-19, 2015 • Phoenix

Where Did the Water Go?

2015 Arizona Hydrological Society Annual Symposium

- When: September 16-19, 2015;
- Where: Desert Willow Conference Center, Phoenix, Arizona; and
- Symposium webpage link: <http://ahssymposium.org/2015/>

Anyone having any questions about this event please contact: Keith Scoular at (480) 894-5477 or e-mail - kscoular@acstempe.com.

Up-coming Arizona Geological Society Dinner Meetings

Date	Speaker	Title of Presentation
10/6/2015	Caleb King	Eocene Ore Deposits of the Greater Battle Mountain Area, Nevada
11/3/2015	Karen Kelley	The Giant Concealed Pebble Cu-Au-Mo Porphyry Deposit, Southwest Alaska: Evolution and Exploration Implications
12/1/2015	Peter Smith	Lunar and Planetary Sciences Department, U of A - Title to be Announced/

Looking for a Gift for Your Favorite Geologist or Yourself?

In-print AGS publications are available for sale at the Arizona Experience Store, located at 416 West Congress Street, Tucson. Copies of current AGS Field Trip Guidebooks and Digests also will be for sale at a reduced price at the September dinner meeting. A list of in-print publications can be found on the [AGS website](#).

Arizona Geological Society Membership Stats (8/22/2015)

Total Membership	Professional Members	Student Members	Organizational Members
560	431	122	7

Arizona's Copper Industry Throughout History



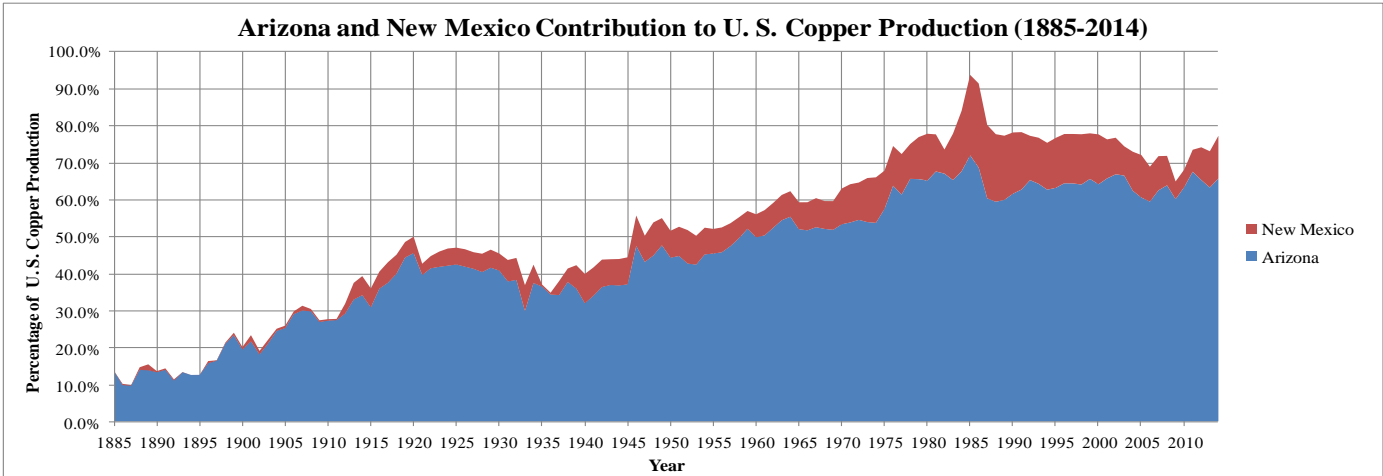
Panorama of Morenci Operation (August 2010)



Pima-Mission Mine (August 2014)



Campbell Shaft at Bisbee (May 2015)



Arizona Geological Survey News Brief



[Arizona Mining Review](#) (AMR) e-Video Magazine – 8/26/2015

The August episode of the [Arizona Mining Review](#) (AMR) will be released at our Youtube channel by 10am, Wed. 26 August:

- Arizona mining update with Nyal Niemuth (AZGS)
- Gold King Mine Spill – An elegant solution for mitigating acid mine drainage, Gail Heath (Res. Prof., Lowell Institute for Mineral Resources, Univ. of Arizona)
- U of A launches the Global Mining Law Center – James E. Rodgers School of Law (Univ. of Arizona) – John Lacy (Attorney & Prof. of Practice)

AZGS News

Dr. Lee Allison will represent the Arizona Oil and Gas Conservation Commission (AZOGCC) during its upcoming Sunset Review before the Arizona Legislature on 25 August 2015. Since 1991, the AZOGCC has resided with the AZGS. Research Scientist Steve Rauzi is the AZOGCC administrator.

AZGS and AZ Dept. of Emergency Management and Military Affairs are once again hosting the Great Arizona ShakeOut earthquake preparedness drill. Scheduled for 10:15 am on 15 October, more than 58,000 people are enrolled. Are you? Register at <http://shakeout.org/arizona/register/index.php>

New Publications – Online at the AZGS Document Repository

Spencer, J.E. and Niemuth, N.J., 2015, [Silica-sand deposits in Arizona](#). Arizona Geological Survey Open File Report, OFR-15-04, 8 p.

Johnson, B.J., Spencer, J.E. and Pearthree, P.A., 2015, [Geologic map of the Arizona part of the Gene Wash 7.5' Quadrangle, Mohave and La Paz Counties, Arizona](#). Arizona Geological Survey Digital Geologic Map DGM-110, 1 map plate, 1:24,000.

ANNOUNCEMENTS

Welcome New AGS Members

Casimer Jacyna	Bridget Valenzuala
Mark Orr	Britton Wanlass
Kazi Roni	

Arizona Geological Society is grateful to Freeport-McMoRan, Inc for their generous support of our student members!



Freeport-McMoRan is sponsoring student dinners for the 2015 AGS monthly meetings.

2015 AGS MEMBERSHIP APPLICATION OR RENEWAL FORM

Please mail check with membership form to: Arizona Geological Society, PO Box 40952, Tucson, AZ 85717

Dues (check box) 1 year: \$20; 2 years, \$35; 3 years: \$50; full-time student (membership is free)

NEW MEMBER or RENEWAL? (circle one) Date of submittal _____

Name: _____ Position: _____

Company: _____

Mailing Address: _____

Street: _____ City: _____ State: _____ Zip Code: _____

Work Phone: _____ Home Phone: _____

Fax Number: _____ Cellular Phone: _____

E-mail: _____ Check this box if you do not have an email address

All newsletters will be sent by email. If you do not have an email address, we will mail a hard copy to you, but we cannot guarantee timeliness.

If registered geologist/engineer, indicate registration number and State: _____

Enclosed is a _____ tax-deductible contribution to the J. Harold Courtright or the Arizona Geological Society Scholarship Funds.