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AGS Newsletter

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April AGS Evening Presentation: Basin evolution, deformation, and mineralization in Big Sandy Valley, northwestern Arizona

Brian F. Gootee and Carson A. Richardson Arizona Geological Survey, University of Arizona Tues. 2 Apr at Hexagon Mining, Tucson

To attend in person, please register at: <u>https://www.arizonageologicalsoc.org</u>

Big Sandy Valley in northwestern Arizona is a large, exceptionally well-exposed extensional basin with complex Proterozoic bedrock, multiple Laramide porphyry stocks, the Miocene Kaiser Spring volcanic field, two generations of Miocene to Pliocene basin fill, interbedded rock-avalanche deposits, and middle Miocene and younger faults. Systematic geologic mapping in this basin was initially motivated by several factors: ongoing copper and lithium exploration, 3D structural and stratigraphic controls on mineralization and groundwater, and U.S. Hwy 93/Interstate 11 infrastructure.

Proterozoic rocks in the Hualapai Mountains were intruded by the Cretaceous Wikieup, Diamond Joe, and Wheeler Wash stocks with associated (but variably developed) porphyry alteration. A fourth Laramide stock near Devil's Canyon is not exposed, and instead a monzonite to quartz monzonite porphyry dike swarm is present.

A poorly exposed, east-dipping, low-angle normal fault is present along the eastern margin of the northern Hualapai Mountains. This fault is not exposed farther south near the Diamond Joe pluton, but the Big Sandy prospect has rocks of the same composition and age and is interpreted as the faulted top of the Diamond Joe pluton transported ~13 km to the ENE (Bell Copper, 2021). Still farther south, a moderately ENE-dipping normal fault is exposed near the Wikieup pluton and may be the southern continuation of this same fault. Thermochronologic cooling ages (AHe, AFT, and ZHe) of the major plutons suggest rapid middle to late Miocene exhumation of the Hualapai Mountains, while Late Cretaceous to Paleogene cooling ages (ZHe and AHe)...

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April AGS Evening Presentation (continued...)

...of a Cretaceous dike in the Aquarius Mountains suggest the Aquarius Mountains were a structurally higher level of the crust during that time.

The oldest basin-fill deposits, informally called the Tule Wash beds, are a sequence of limestone, basalt, mudstone, sandstone, and conglomerate lithofacies up to 1,500-2,000 m thick. In northern Big Sandy Valley the depositional axis of the Tule Wash basin was located on the far eastern side of the valley, as indicated by multiple interbedded rock-avalanche breccia-flows sourced from the Hualapai Mountains. Across much of the valley width the Tule Wash beds are predominantly W-tilted into E-dipping faults; along the Aquarius Mountains the dip polarity flips into generally ENE-tilted fault blocks cut by N- to NW-striking faults with major WSW-side-down slip. After deposition and deformation of the Tule beds, a basin-wide erosional event formed an angular unconformity over the Tule Wash beds; eroded Tule Wash deposits were transported south to an unknown depocenter. In the southeastern Aquarius Mountains, the ~15-8 Ma Miocene Kaiser Spring volcanic field, a bimodal complex assemblage of felsic lava domes, mafic lava flows, breccias, and pyroclastic rocks, was emplaced over an eroded crystalline bedrock surface that also overlapped with Tule Wash deposition and deformation.

Flows from the Kaiser Spring volcanic field blocked the southern exit from Big Sandy Valley, forming a closed between ~10-5 Ma. This basin was filled by the Big Sandy Formation, a basin-wide fanglomerate, sandy, muddy and carbonate assemblage. Lithium mineralization near the community of Wikieup is hosted within the muddy lithofacies of the Big Sandy Formation, but the source rocks and mechanism of lithium mineralization remains debated. By ~5 Ma, the Big Sandy Formation aggraded with sediment and water to a maximum floor elevation of ~750 m above sea level at its southernmost terminus and spilled across crystalline bedrock where the northern Poachie and southern Hualapai Mountains meet. Since then, Big Sandy Valley has undergone erosion with a series of off-lapping alluvial terraces cut into older basin fill deposits. Though Big Sandy Formation is largely undeformed, one fault zone on the west side of the valley offsets late Pleistocene and older deposits.



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AGS Spring 2024 Big Sandy Valley Field Trip Basin evolution, deformation, and mineralization in the Big Sandy Valley, northwestern Arizona

Register at https://www.arizonageologicalsoc.org/

Leaders: Brian F. Gootee, Lisa A. Thompson, Bradford J. Johnson, and Carson A. Richardson (Arizona Geological Survey, University of Arizona)

When/Where: Saturday, 27 April 2024 to Sunday, 28 April 2024 (We recommend arriving the afternoon/evening of Friday, 26 April 2024 and either camp in Big Sandy Valley or find accommodation in Kingman)

Registration: This trip will be limited to 25 attendees, who will be selected by lottery after a ten-day open registration. Register at <u>https://www.arizonageologicalsoc.org/</u>

Transportation: You are responsible for your own transportation. To facilitate carpooling for Tucson- and Phoenix-area folks, AGS will communicate the list of attendees before the trip. High-clearance vehicles are required in the field, such as Cherokee or F-150 4x4's.

Disclaimer: All field trippers must sign an AGS liability release waiver.

Gear: Dress appropriately for daytime temperatures 75-90 degrees F. Boots or hiking shoes are required. AGS will supply some water, but please bring some with you.

Cost: S25 for two lunches on 27 and 28 April. Cost of field guide is S20 for a total of S45. The fee would not be collected until after the lottery.

Description: This field trip, encompassing basin deposits, river integration, structural geology/tectonics, economic geology, and regional geology, will examine two generations of well-exposed basin deposits and associated faults and deformation in Big Sandy Valley, northwestern Arizona. Big Sandy Valley is situated along the margin between the Basin and Range Province and Transition Zone in Arizona within a ~90 km gap along the northwestern segment of the Laramide arc where no porphyry copper deposits have yet been defined. Two sedimentary lithium deposits were discovered in 2019 and continue to be advanced, while two subsurface porphyry copper prospects are being explored by junior mining companies.

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AGS Spring 2024 Big Sandy Valley Field Trip Basin evolution, deformation, and mineralization in the Big Sandy Valley, northwestern Arizona (continued...)

Register at https://www.arizonageologicalsoc.org/

...By examining the spatial distribution and geometric configuration of Big Sandy basin deposits, trip participants will evaluate and make connections between basin structural evolution, depositional systems and basin sedimentation, and modern resource exploration, highlighting the role geologic mapping plays in the intersection of science, policy, and land use. Field trip stops examine four aspects of basin evolution and mineral resources: 1) evaluate the character, form, and depositional environments of two generations of basin deposits (the Miocene Tule Wash beds and late Miocene-early Pliocene Big Sandy Formation) through type exposures; 2) examine the character, provenance, and depositional mechanisms of spectacular rock-avalanche breccia deposits in the Tule Wash beds; 3) evaluate the structural setting of basin deposits, cross-cutting relationships between faults and folds, and implications for the style and timing of deformation; and 4) summarize regional geology and implications for porphyry copper and sedimentary lithium mineralization.

Trip Leaders







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AGS Financial Resources 2024

Benedek Gál AGS Treasurer 2024

The AGS derives most of its current financial resources from the S35 annual membership dues. As of 3/16/2024, AGS has 344 active members, which includes 42 student members; students pay no annual fee. For 2024 that equates to S10,570.

Field trip fees and book sales yield some revenue as well. Field trip fees are set to cover AGS costs – vans, gas, meals, field guide – and do not provide substantial income.

Costs associated with monthly talks (speaker travel reimbursements, refreshments & food) are partly offset by the registration fees, with corporate sponsors often covering the difference in the past. AGS formerly paid a substantial fee to host monthly presentations at local hotels, e.g., Sheridan Tucson at 5151 E. Grant St. In 2023 and 2024, Hexagon Mining has provided a venue at no cost. AGS Executive Committee thanks Hexagon for their support.

Book sales are limited to sales of several hundred Geologic Highway Map of Arizona annually, which nets the Society about S4 per map. And each year, Eric Seedorff (UArizona Geosciences) purchases several hundred dollars of texts and field guides for his professional geosciences workshops.

In past years, conferences were a major source of income, but they occur infrequently. The last conference, 'Ores & Orogenesis 2007', registered more than 800 people and required approximately 3 years of planning, more than 30 AGS volunteers' work, and approximately S100,000 in seed money (E. Seedorff pers. Comm., 2024).



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AGS Financial Resources 2024 (continued...)

<u>AGS Investment Portfolio</u> is managed by RBC Wealth Management Branch – Tucson. For more than a decade, Ted Eyde has chaired the AGS Investment. AGS Executive Committee thanks Ted for his years of service and for keeping us in the black.

Current Status of AGS Investment Portfolio with RBC Wealth Management		
AGS INVESTMENT PORTFOLIO	Current \$	Growth in 2023
Arizona Geological Society Account:	\$93,962.62	\$6,051.27
AGS Courtright Scholarship Account:	S65,702. 99	\$1,499.61
AGS M. Lee Allison* Scholarship Acct:	<u>\$62,378.09</u>	<u>\$1,257.75</u>
Total:	\$222,043.70	\$8,808.63

*In 2016 the former AGS Scholarship was renamed the M. Lee Allison Scholarship.

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Growth of AGS portfolio over 2023 is ~4.1%. At current growth rate the Scholarship accounts are not sustainable without the addition of funds producing at a minimum \$3,000 annually. The Courtright and Allison scholarship funds pay out \$3,000 annually. Of note, member donations to the scholarship funds are tax deductible and are always greatly appreciated. The Society expresses its gratitude for past donors for supporting local talent in their studies and research projects.

AGS Cash Resources (03/18/2024)	Current
Savings Account	S21,359.72
Checking Account	\$1,158.82
Major Operating Expenditures	
All American Storage Closet	\$2,300/yr
Accountant/Tax	approx. \$100/m
Wild Apricot Website/Webshop	\$2,590/yr
USPS PO Box fee	S194/yr



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Arizona Ranks #2 in Production of Nonfuel Mineral Commodities

The US Geological Survey just released, "Mineral Commodity Summaries 2024". Select highlights of Arizona's standing in nonfuel mineral production for 2023 follows. You can access and download the 216-p report at <u>https://pubs.usgs.gov/publication/mcs2024</u>.

AZ – 1st in copper production, accounting for 70% U.S. production;

AZ – 1st in natural gemstone production;

AZ – 2nd in nonfuel mineral production with S9.5 billion (TX was #1 this year at S9.75 billion. NV was #3.);

AZ – 3rd in production of construction sand and (CA and TX produced more.).



Partial total, excludes values that must be withheld to avoid disclosing company proprietary data, which are included with "Undistributed" in table 3.



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Arizona Geological Survey Publications Feb-Mar 2024

Holm, R.F. and Wade, W.J., 2024, Cone Morphology, Volcanic Deposits, and Eruption and Deposition Mechanisms at Red Mountain, Northern Arizona. Arizona Geological Survey Contributed Report CR-24-A, 19-p. <u>https://library.azgs.arizona.edu/item/AGCR-</u> <u>1709677235826-954</u>

Johnson, B.J., Gootee, B.F. and Beers, R.L., 2024, Geologic Map of the southern half of the Tom Brown Canyon 7.5' Quadrangle, Mohave County, Arizona. Arizona Geological Survey DGM-229, 1 Pamphlet, Map scale 1:24,000. https://library.azgs.arizona.edu/item/ADGM-1709240073836-242

Thompson & 4 others, 2024, Geologic Map of the Bottleneck Wash 7.5' Quadrangle, Mohave County, Arizona. Arizona Geological Survey DGM-225, 1 Pamphlet, Map scale 1:24,000. <u>https://library.azgs.arizona.edu/item/ADGM-1709239786818-48</u>

Young, R.A., 2024, Brief Cenozoic Geologic History of the Western Grand Canyon Region on the Milkweed Canyon NW and Hindu Canyon 7.5' Quadrangles with an Emphasis on the Exhumed Hualapai Plateau Paleocanyons, Mohave County, AZ. Arizona Geological Survey CM-24-A, Report and three plates. <u>https://library.azgs.arizona.edu/item/AGCM-</u> <u>1709678251565-357</u>



Left, cover of Red Mountain paper. Right, Geologic map of Bottleneck Wash, Mohave County, Arizona.

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AGS on the hunt for a Newsletter Coordinator

AGS on the hunt for a Newsletter Coordinator

Are you passionate about communication and organization? Do you have a knack for crafting engaging content? We're on the lookout for a dedicated individual to take the reins on our monthly newsletter!

As the Newsletter Coordinator, you'll have the opportunity to curate and compile the latest updates, announcements, and highlights from our AGS community. Whether you're a seasoned wordsmith or looking to hone your editorial skills, this role offers a platform to showcase your creativity and keep our members informed and inspired.

If you're ready to make your mark and contribute to the vibrant pulse of AGS, we want to hear from you! Reach out to us today to learn more about how you can become our next Newsletter Coordinator. Let's collaborate to keep our community connected and thriving!

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New Arizona Mineral Districts v. 3: La Paz & Yuma Counties

Long-time Arizona Geological Society members, Jan Rasmussen and Stan Keith have recently published "Arizona Mineral Districts v. 3, La Paz and Yuma Counties. This is a detailed reference work describing the geology, mineralogy, age dates, locations, and past production of the mineral districts within La Paz and Yuma counties, Arizona. It is profusely illustrated with 1"62,500-scale topographic maps, mine maps, cross sections and photographs of old mines, and minerals. It also includes a detailed table of the geologic history of Arizona. Price S56.19

Copies of both hardback and paperback versions of this publication can be purchased from <u>Amazon.com</u>.

March, 2024

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Arizona Geological Society Photo of the Month

Spectacular outcrop in Burro Wash, Tule Quadrangle, Mohave County. Drone image and annotation by Brian Gootee (AZGS Research Scientist).