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GEOLOGIC MAPPING IN ARIZONA:
RECENT PROJECTS AND FUTURE DIRECTIONS

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Introduction

Detailed geologic mapping at 1:24,000 scale is one of AZGS's core activities that supports development, hazard mitigation, and scientific endeavors across Arizona. Nearly all our mapping is funded by the USGS STATEMAP program and prior to 1993, the USGS COGEOMAP program. These programs have enabled AZGS to complete detailed mapping across ~17% of Arizona, with a total of ~33% of the state mapped at 1:24,000 scale when including academic and USGS contributions (Fig. 1). Nearly four decades of intensive mapping still leaves much of Arizona to be covered. Since the implementation of the U.S. GeoFramework Initiative (Shelton et al., 2022), STATEMAP funding awarded to Arizona has increased from about $158,000 (FY2019) to $521,000 (FY2025), which has enabled AZGS to complete more ambitious projects and provide more geochemical and geochronologic data in areas of interest. AZGS maps are thus increasingly valuable as precompetitive data and catalysts for scientific research.

In addition to detailed mapping, compilation mapping at 1:100,000 scale has been a relatively recent focus of AZGS largely due to changes to the STATEMAP guidance criteria and the beginning of the U.S. GeoFramework Initiative. Intermediate-scale maps provide regional syntheses of volcanic-magmatic systems, stratigraphy, and depositional systems, illustrating much broader connections than is possible at 1:24,000 scale. Since 2020, AZGS intermediate-scale mapping efforts have completed a large swath of contiguous mapping in central Arizona that covers many areas that are most important to the state's urban development, water use, and mineral resources (Spencer et al., 2022; Richard et al., 2023; Pearthree et al., 2024a,b; Pearthree and Mako, 2024; Pearthree et al., 2025). Future detailed and intermediate-scale mapping will be guided by issues that are of greatest importance to the state of Arizona. We continue to be focused on providing geologic mapping as pre-competitive data for critical mineral and material exploration. We are also attentive to the intersection of geologic hazards including landslides, active faults, earth fissures, and flooding with intense industrial and residential development. Ongoing geologic mapping will also support AZGS's new efforts to explore and identify favorable geologic settings of Arizona's geothermal resources. Ultimately, providing detailed geologic mapping across a range of scales serves Arizonans with the tools and insight needed to make proactive, strategic choices regarding resource management and sustainable development.

The Contributions of Phil Pearthree

As Dr. Phil Pearthree transitions from his State Geologist and Director roles, we reflect on his substantial contributions to geologic mapping in Arizona (Fig. 1). His expertise in surficial geology, geomorphology, and geologic hazards has left a profound mark on the AZGS catalogue with numerous landmark maps and papers. His interest in Colorado River integration earned him, with Kyle House and Mike

Perkins, receipt of the prestigious Kirk Bryan Award from the Geological Society of America in 2013. In that paper, the role of lake spillover in the origin of the Colorado River was introduced with compelling stratigraphic evidence revealed in geologic mapping efforts (House et al., 2008). Related work (e.g., Spencer et al., 2008; Pearthree and House, 2014) along the lower Colorado River spurred continuing interest, controversy, and notable scientific progress in Colorado River geoscience. Phil's keen interest in extreme floods (House and Pearthree, 1995), paleofloods (e.g., House et al., 1995; House et al., 2002) and alluvial fan flood hazards (e.g., Vincent et al., 2004; Pearthree et al., 1991, 2004, 2020) reflect his career-long commitment to understanding and characterizing hazardous fluvial processes, geomorphology, and surficial geologic mapping, often in the interest of public safety. Likewise for his numerous contributions in Quaternary faulting/neotectonics in Arizona (Pearthree, 1986; Pearthree, 1998; Menges and Pearthree, 1993).

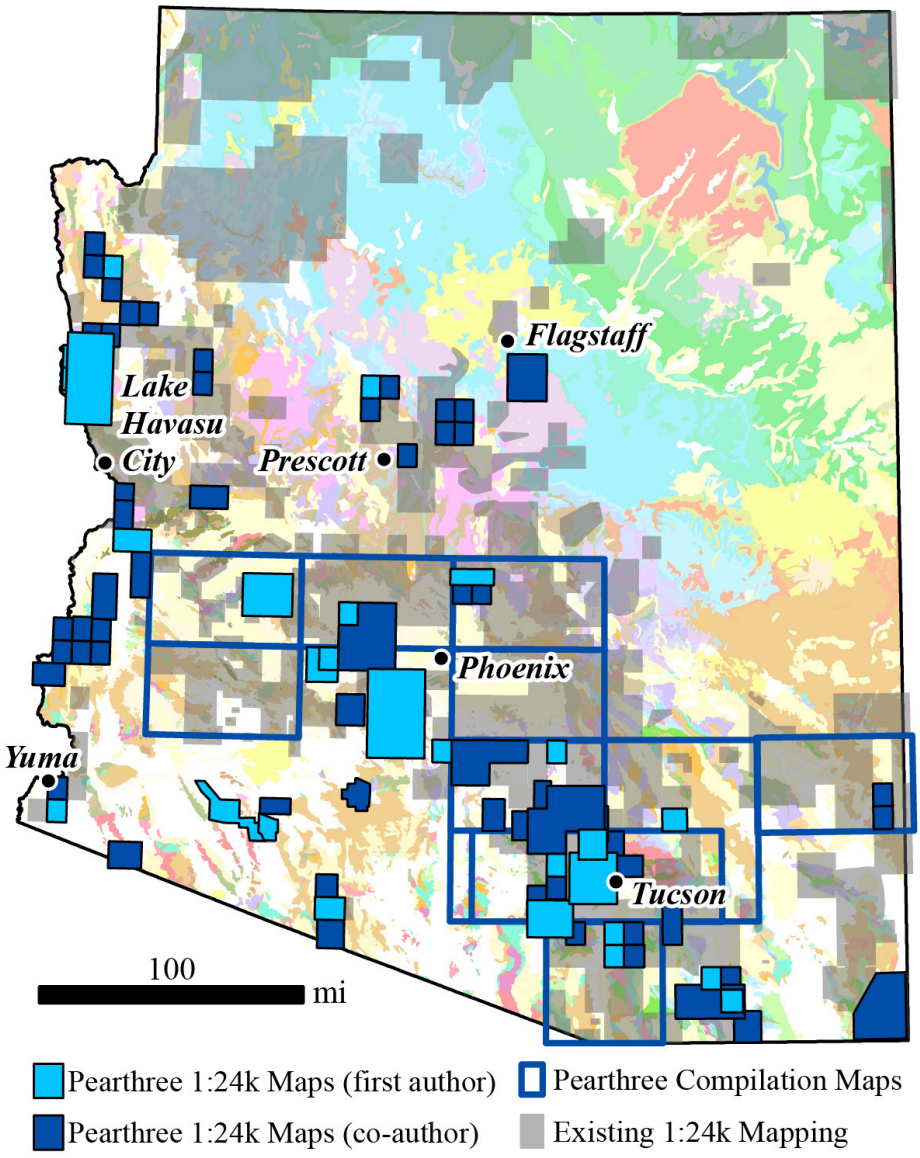

Figure 1. Geologic map of Arizona (after Richard et al., 2000) highlighting the career mapping contributions of Dr. Phil Pearthree (blues), outgoing State Geologist, as well as existing 1:24,000-scale mapping (grey)

Mission

To inform and advise the public about the geologic character of Arizona in order to increase the understanding and encourage prudent development of the State's land, water, mineral, and energy resources.

Activities

Public Information

Inform the public by answering inquiries; maintaining a library, databases, online repositories, and a website; giving talks; and leading fieldtrips.

Geologic Mapping

Map and describe the origin and character of rock units and their weathering products.

Geologic Hazards

Investigate geologic hazards and limitations such as earthquakes, land subsidence, flooding, and rock solution that may affect the health and welfare of the public or impact land and resource management.

Energy and Mineral Resources

Describe the origin, distribution, and character of metallic, nonmetallic, and energy resources and identify areas that have potential for future discoveries.

Phil's surficial geologic mapping efforts and linkages to aggregate material resources represent a commitment to other practical applications of surficial geologic mapping (e.g. Pearthree et al., 2015). Dr. Pearthree's gift for regional-scale assessment spans many decades, from his early compilation of the Tucson 1°x2° sheet (Pearthree et al., 1988) to the recent Safford 30'x60' map (Pearthree et al., 2025), to compilation of surficial geology of the entire state for the geologic map of Arizona (Richard et al., 2000) and an ongoing revision of the state geologic map. Dr. Pearthree has contributed to detailed geologic maps covering ~10% of the state and intermediate-scale compilation maps of ~20% of the state. Dr. Pearthree's methodology and approach will undoubtedly continue to guide our mapping for decades to come.

Geologic Mapping in Big Sandy Valley and Vicinity

Since the last mapping update in 2021 (Richardson and Pearthree, 2021), AZGS has completed a major effort to map Big Sandy Valley at 1:24,000 scale (Fig. 2). This area drew our focus due to contentious water use issues, abundant mineral resources, and unanswered questions about the basic structural geology and basin development history. From 2020 to 2023, 9 maps were produced at 1:24,000 in the Big Sandy Valley (Gootee and Johnson, 2023; Ferguson et al., 2023; Thompson et al., 2023a; Richardson et al., 2024; Garcia & Thompson, 2024; Garcia et al., 2024; Gootee et al., 2024a; Johnson et al., 2024; Thompson et al., 2024a), with an additional 3 quadrangles along I-40 to the north (Thompson et al., 2024b; Ma and Kwiatkowski, 2025; Kwiatkowski et al., 2025) (Fig. 2B). The maps document the distribution of two mid- to late Cenozoic basin-fill successions. The lower succession consists of up to 2,000 m of clastic sedimentary rocks with intercalated rock-avalanche deposits, basalt flows, and minor limestone and tuff that have been dissected and tilted by Basin-and-Range normal faults. Preliminary geochronology indicates that this older succession was deposited from ca. 23-10 Ma (Gootee et al., 2025). The younger succession, which is generally undeformed, was deposited after extensional faulting and basin-wide erosion. The structural, stratigraphic, and economic findings from these cumulative mapping initiatives were compiled and presented during the April 2024 Arizona Geological Society spring field trip, with the guidebook subsequently published by the AZGS (Gootee et al., 2025).

To the south and east of Big Sandy Valley, USGS Earth-MRI funded mapping in the Kaiser Spring volcanic field produced the first 1:24,000-scale map of the entire volcanic field (Thompson et al., 2023b). Mapping in this area has catalyzed several scientific studies and industry partnerships including the first geologic characterization of the generically named 'Basin' volcano-sedimentary lithium deposit in Kaiser Spring volcanic field (Thompson et al., 2025). Drill core logs and core and surficial assay data provided by Bradda Head Lithium, Inc., were combined with new geologic mapping, whole rock and trace element geochemistry, and clay XRD analyses, to reveal sedimentological and stratigraphic evidence for a buried Miocene-aged maar crater filled with lithium-rich clay, pyroclastic rocks, and basalt flows. In collaboration with Bell Copper, two University of Arizona Master's theses have been completed, correlating the exposed Diamond Joe pluton with the buried Big Sandy porphyry copper system (Chappell, 2025) and mapping alteration (funded by EDMAP) in the Diamond Joe Pluton (Sojo, 2025).

A 3D mapping project was funded by STATEMAP in 2022 to use our new 1:24,000-scale mapping and existing well logs to construct a detailed model of the basin geometry in Big Sandy Valley (Gootee et al., 2024b). This project produced a new depth-to-bedrock contour map (Fig. 2C), isopach maps of the basin-fill units, and a geologic map of the sub-basin bedrock. This information is intended to improve understanding of the basin architecture, which is necessary for exploration, modeling, and management of groundwater aquifers, porphyry and mineral systems, and geothermal resources (Bain, 2015; Chappell, 2025; Sojo et al., 2025).

Detailed mapping in the northern Hualapai mountains has yielded high REE whole rock geochemical data, warranting further investigation (High REE granites, Fig. 2B). Whole rock geochemical analyses of igneous and metaigneous rocks in the Hualapai Spring quadrangle yielded nine samples with >1000 ppm total rare earth elements and >300 ppm Ce (Ma and Kwiatkowski, 2025). A sample from the nearby Tin Mountain NW quadrangle (Thompson et al., 2024b) yielded similar REE values. These values are two to three times that of typical granitoids and about five times average crustal abundances. For comparison, reports and press releases on the La Paz

REE deposit in the nearby Harcuvar Mountains reports total REE grades of 391 ppm (American Rare Earths, 2021), far lower than samples from the Hualapai Spring and Tin Mountain NW quadrangles.

High REE samples have a distinctive alkaline signature indicating a relationship between REE-enrichment and magma evolution. Alkaline igneous rocks have a known association with REE deposits (e.g. Watts et al., 2021). Additionally, some of the rocks mapped in the Hualapai Spring quadrangle as amphibolites are suspected on further examination to be meta-shonkinites, a highly alkaline augite-porphyritic mafic rock. This style of REE enrichment has not been previously documented in Arizona and

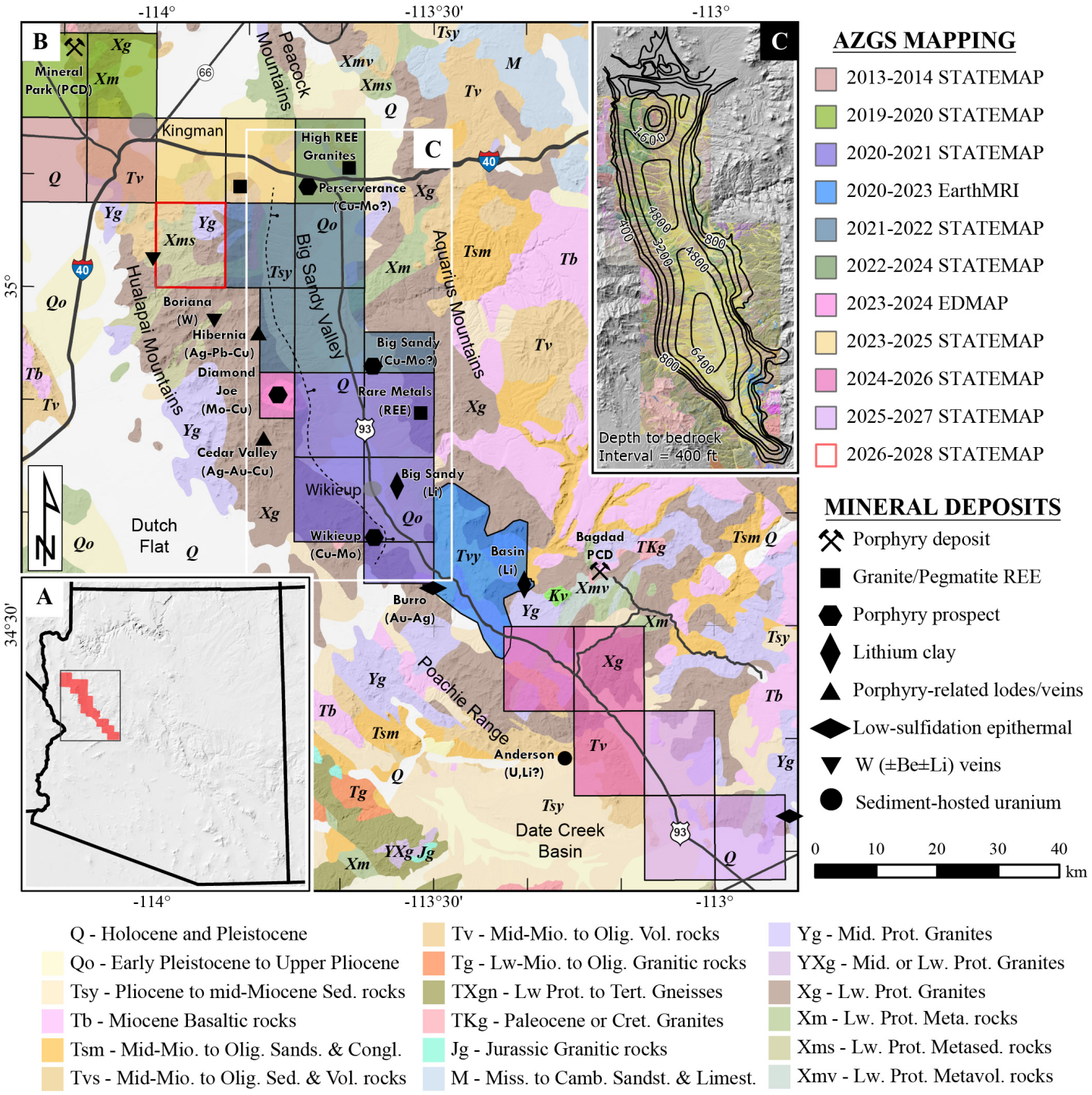

Figure 2. Published and ongoing geologic mapping in the Big Sandy Valley and vicinity, including along I-40 and Rt. 93. A) Area of recent mapping relative to the state of Arizona. Topographic base is USGS 3DEP LiDAR. B) Geologic mapping products colored by funding cycle and source in the Big Sandy Valley area overlain on a geologic map (after Richard et al., 2000). Relevant critical mineral deposits are symbolized. C) New depth to bedrock contours from the Big Sandy 3D project (Gootee et al., 2024b). Scale in panels B and C are identical.

may constitute an important economic mineral system. Future mapping projects in the Hualapai Mountains will continue to explore these associations.

While many of the planned projects that drew AZGS to the Big Sandy Valley have been completed, we will likely continue to focus on this area due to compelling critical mineral interests. Mapping of 6 more 7½' quadrangles is in progress along the Rt. 93 corridor in the Santa Maria and Date Creek basins. Detailed mapping has been an essential catalyst for inspiring further research and applied studies.

Detailed and Compilation Mapping in the Safford 30' x 60' Quadrangle

Recently completed detailed mapping along the eastern border of Arizona centered on the town of Duncan facilitated the completion of a geologic map of the Safford 30'x60' quadrangle (Pearthree et al., 2025) (Fig. 3A). The Safford basin area hosts a diverse array of geology, including the Pinaleño core complex, Cretaceous intrusives (including those at the Safford porphyry copper deposit), several Oligocene to Miocene felsic volcanic centers, the Safford basin itself with its associated basin-fill deposits, and the modern Gila River. Detailed mapping around Duncan (Fig. 3B) was inspired by a 2014 swarm of earthquakes in that area following a magnitude 5.3 earthquake on June 28, 2014 (Dorn et al., 2016). Ultimately, new geologic mapping did not identify any major fault orientations that were similar to the inferred stress orientations of the recent earthquakes (Ben-Horin et al., 2024; Mako et al., 2024) but significant improvements were made to our understanding of the Duncan basin stratigraphy, ancestral and modern Gila River deposits (Gootee et al., 2024c,d), and the structure and stratigraphy of the Miocene-Oligocene volcanic rocks (Mako et al., 2024). The resulting intermediate-scale Safford map will provide an excellent resource for ongoing mineral and geothermal exploration in this area, future studies on river integration and basin filling, and continued land use and development in the Safford Valley.

Ongoing and Future Projects

AZGS has several ongoing mapping projects that will be published as successive STATEMAP funding cycles are completed. Currently, mapping in six 7½' quadrangles is underway along the U.S. Highway 93 corridor (Fig. 2B). The future I-11 interstate highway connecting Phoenix and Las Vegas is planned to be developed from U.S. 93, so our mapping provides important information on potential aggregate resources, flood-prone areas, and active landslide hazards, among others. Three detailed maps will be completed in September 2026 covering the Thorn Peak, Ives Peak, and Arrastra Mountain NE

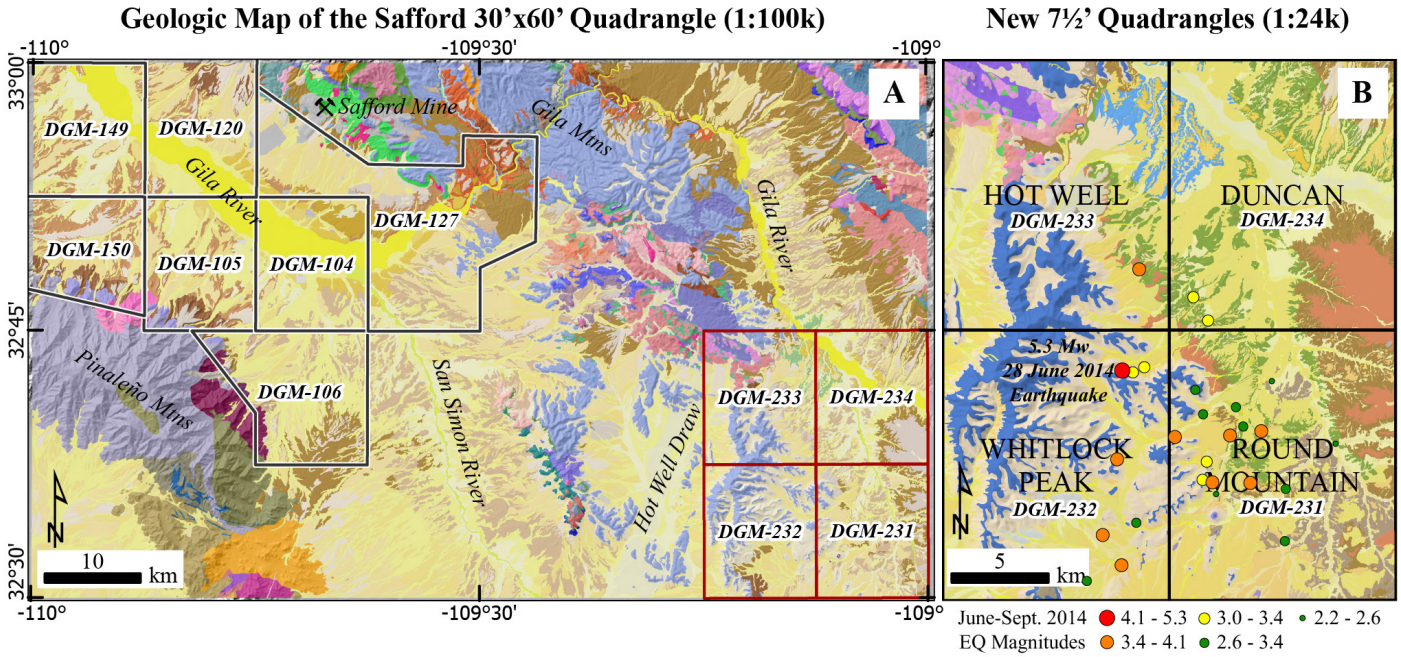

Figure 3. Recent AZGS mapping in the Safford area. A) Geologic map of the Safford 30'x60' quadrangle (Pearthree et al., 2025), 1:100,000-scale, showing the locations of previous AZGS mapping that were compiled. B) Detailed (1:24,000-scale) mapping for 7½' quadrangles (Ben-Horin et al., 2024; Gootee et al., 2024c,d; Mako et al., 2024) centered on the 2014 earthquake swarm.

quadrangles. Three additional maps, continuing south to the Date Creek Range, are slated for publication in late 2027, including the Malpais Mesa, Date Creek Ranch, and O'Neill Pass quadrangles. With the completion of these maps, AZGS will have produced near continuous detailed mapping coverage of the major roadways from Phoenix to Kingman, AZ.

New detailed mapping will start in fall 2026 as the next STATEMAP cycle begins. We have proposed to map the Hualapai Peak quadrangle (Figure 2B) to better understand the Proterozoic REE-rich alkaline intrusive rocks in this area. We also intend to map two 7½' quadrangles in the southern Dragoon Mountains in SE Arizona. The mapping area focuses on the Courtland-Gleeson district, which hosts Cu-rich carbonate replacement deposits, and will clarify complex relationships between Laramide thrusts and a possible Jurassic caldera complex (Lipman and Hagstrum, 1992). This mapping will be synergistic with a EarthMRI project led by Nathan Carey studying carbonate replacement deposits across SE Arizona.

In addition to detailed mapping, a new state geologic map of Arizona is being compiled that will provide a substantial update from the Richard et al. (2000) version. The new state map is being produced at 1:500,000 scale and will include the results of more than two decades of detailed mapping and medium-scale compilations that have been completed by AZGS, USGS, and others since the last edition of our state geologic map. The final version of this map is scheduled to be published in late 2027.

Ongoing intermediate-scale compilation projects include the Phoenix South 30'x60' quadrangle, and a compilation of the Prescott and Sedona areas focused on the Miocene to recent geology of the upper Verde River watershed. The Phoenix South compilation will be completed by fall 2027 while the upper Verde River project will begin this September. Finally, a new compilation of geochronology data throughout Arizona is nearing completion and is expected to be published by the end of 2026.

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At Roberts Mesa the contrast between the dark red mudstone beds and the tan sand-dominated layers above marks the arrival of Colorado River sediment into the Bidahochi Basin 6.6 million years ago. This set the stage for the integration of the Colorado River and the formation of the Grand Canyon. Same photo used in banner on cover. Drone image by Brian Gootee.

The Current State of the Arizona Geological Survey

By Phil Pearthree

This is my final update on the state of the AZGS, as I am stepping down as Director effective July 6, 2026. My successor, Brian Gootee, will be transitioning from leading our Energy Geology Group. Brian was selected as the next Director and State Geologist by Dean of Science Carmine Garzione after a nationwide search, following the unanimous recommendation of our search committee. Brian is highly qualified to assume the leadership role: he is an excellent geologist who has made important contributions to the work of the AZGS in many different areas; he has tremendous people skills and has been very successful establishing private sector and agency contact, and has built coalitions to pursue funding opportunities; he has managed large and complex projects; and he is a wonderful manager of people. I could not be more comfortable passing leadership responsibilities to Brian, especially since he will be ably supported by our Assistant Director for Business/Finance Randi Bellassai.

These are exciting times at the AZGS. Our staff members are engaged in diverse research activities and investigations; we are conducting more applied research focused on the State of Arizona than ever before. Our total annual funding for Fiscal Year 2025-26, including our state appropriation and external grants, was $4M. That is more than twice as large as our total funding in 2020 and primarily reflects a dramatic increase in external funding. We have 30 active externally funded projects with several additional large grants in the negotiation or development process, and we have 28 permanent staff members engaged in geologic mapping, mineral resource investigations, hazards research and investigations, energy resources, GIS, digital data and public outreach, and administrative support. The growth of the AZGS should be attributed primarily to our knowledgeable and highly motivated staff, who seize opportunities for external funding and produce high quality research in a timely manner. Looking to the future, the AZGS will continue to explore the critical mineral resource potential of Arizona, investigate geologic hazards that threaten lives and property, increase our understanding of the potential for energy resource development, and provide important geologic information to the public.

It has been a great honor to serve as Director and State Geologist. I believe we have built a very strong foundation within the University of Arizona and look forward with anticipation to the great things the AZGS will accomplish in the coming years.

Research Group Updates

Mineral Resources: As we enter the final year of supplemental funding from the USGS' Earth Mapping Resources Initiative (Earth MRI), our team is busily working on four major geochemical reconnaissance projects funded through Earth MRI. The first project involves the reanalysis of samples along the Kanab Plateau and Mogollon Slope in northern Arizona. Marcus Silva is in the final stages of sample characterization and data analysis and plans to publish results later this year. Our geochemistry of Proterozoic rocks and ore deposits project is ongoing, with detailed deposit studies on the Zonia oxidized copper deposit and the Antler volcanogenic massive sulfide deposit well underway. Zoey Carey will present a poster at the Society of Economic Geologists' annual conference in October highlighting her work on the Zonia deposit. Calvin Mako, the PI for this project, continues with his ambitious statewide sampling campaign and associated geochronology, geochemistry, and petrography. The newest member of the mineral resources team, Billy Fitzpatrick, has made great progress in identifying appropriate sites and sampling for our ongoing geochemical reconnaissance of southwest U.S. Mo-W deposits. These projects end in mid-2027: stay tuned for publications. The newest addition to our Earth MRI slate of projects is the focus of Nathan Carey's Ph.D. at the University of Arizona. The project investigates the critical mineral potential of CRD and skarn deposits in southeastern Arizona. These deposit types are often high-grade, sulfide-rich, polymetallic systems hosted in Paleozoic carbonates.

We continue our mine waste projects, which are also funded through the USGS Earth MRI program, and are aimed at determining the critical mineral potential of legacy mine waste in Arizona. Ongoing work includes inventorying of mine waste features throughout the state with ArcGIS, and sampling and characterizing tailings at a number of former mine and mill sites across Arizona. Detailed petrographic and geochemical analyses of tailings material from each site will reveal the mineral phases and elements left

behind in the waste and inform any future reprocessing efforts aimed at extracting additional commodities. This inventory and characterization work, led by Marcus Silva, will continue through 2028.


Mine waste sampling in Mojave County, Arizona. Photo by Marcus Silva

In March 2026, the minerals team published part one of the Earth MRI funded Late Cretaceous to early Paleogene ("Laramide") plutonic rocks and porphyry systems, Arizona as AZGS OFR 26-7. This publication includes 498 new whole-rock geochemical analyses, 1,279 compiled analyses from geologic literature, and an additional 51 new analyses published separately in AZGS OFR 26-6. The bulk of the samples are plutonic rocks, with a lesser number of volcanic rocks, ore samples, sedimentary/skarn samples, and rare metamorphic rocks. These geochemical analyses were subsequently studied to better understand the distribution of critical minerals in the Laramide porphyry systems. This work resulted in numerous geochemical plots and associated discussion which outline the enrichments and depletions of critical and non-critical elements in Laramide porphyry-related intrusive rocks based on rock type, alteration type, and age. Additionally, the report includes a compilation of available production, resource, reserve, and inventory data for Laramide porphyry copper systems in Arizona and New Mexico.

We also have projects funded through the USGS' National Geological and Geophysical Data Preservation Program (NGGDPP). Our current projects aim to inventory and scan two donated geologic collections which contain geologic maps, mining reports and correspondences, photographs, and original research. An additional funded project will include geochemical sampling of select core from the AZGS Drill Core Repository.

Previous USGS NGGDPP funding allowed re-establishment of the AZGS Drill Core Repository. In the months following the publication of our repository webmap and the associated publication by Carson Richardson and Nathan Carey, which highlights its contents, the minerals team has had a marked increase in visitors requesting to view core. This is a great example of how we are able to leverage federal funding to better serve the public. In the past 6 months, the minerals team also published AZGS OFR 26-3, which provides an overview of the Mineral Resources of Cochise County, Arizona and AZGS OFR 26-5 which inventoried the donated Eric Seedorff Rock Sample Collection which is presently available for viewing upon request.

Energy Geology: The Energy Geology Group develops and executes research projects on surface and subsurface geologic resources within Arizona's sedimentary basins. The group currently manages three active projects and continues to expand its portfolio in geothermal energy, carbon management, and subsurface resource characterization.

In early 2026, the Energy Geology Group launched the Arizona Geothermal Data Catalog, a new project funded by the Arizona Governor's Office of Resiliency to conduct a statewide evaluation of geothermal resources. The project will compile and integrate legacy datasets, interpret new and existing geologic information, and evaluate subsurface conditions to improve understanding of Arizona's geothermal potential.

The Energy Geology Group is completing two Department of Energy-funded projects expected to conclude this fall. The first supports Arizona State University's Southwest Regional Direct Air Capture (DAC) Hub and evaluates site suitability for carbon dioxide (CO_2) injection in northeastern Arizona. The second is a collaborative effort with New Mexico and Utah to develop a framework for Carbon Capture, Utilization, and Storage (CCUS) as part of CUSP: Four Corners Regional Initiative.

Beyond active projects, the group remains heavily engaged in proposal development and collaborative activities supporting geothermal exploration and development throughout Arizona and the western United States. Negotiations with DOE continue regarding a provisionally-awarded deep characterization well in the Harquahala basin west of

Phoenix to evaluate subsurface carbon storage and resource potential. They also recently participated in multiple DOE funding submissions for geothermal exploration and continues to collaborate with neighboring states on regional geothermal resource initiatives across the Southern Basin and Range Province. In May, AZGS participated in a technical tour of Fervo Energy's Cape Station project near Milford, Utah, where staff joined state energy officials and geoscientists from across the Intermountain West to learn about advances in enhanced geothermal systems (EGS), drilling technologies, reservoir engineering, and geothermal power generation. The tour provided valuable insights into emerging geothermal technologies and their potential applications in Arizona.

A Fervo Energy engineer explains the operation of Cape Station's geothermal power plant, highlighting heat-exchange systems and power-generation infrastructure. Photo by Brian Gootee

Looking ahead, the Energy Geology Group anticipates continued growth in geothermal exploration, subsurface energy storage, carbon management, and evaluation of deep geologic resources, including pore-space utilization, carbon mineralization, and gas storage in bedded salt formations. These efforts are supported through ongoing collaboration with Arizona utilities and state agencies, including the Arizona Department of Environmental Quality (ADEQ), Arizona State Land Department (ASLD), Arizona Oil and Gas Conservation Commission (OGCC), and the Arizona Governor's Office of Resiliency.

This quarter, the Energy Geology Group celebrates several notable staff accomplishments. Zsofia Poros joined AZGS in April and brings 14 years of experience in research and reservoir characterization within the oil and gas industry. She has worked as a reservoir geologist on exploration, appraisal, and development projects, with strong expertise in carbon capture and storage, along with experience in geothermal resource assessment. Tawnya Wilson was recognized with the University of Arizona College of Science Staff Excellence Award for her outstanding leadership of multiple projects and proposals, and Lisa Thompson will transition into the role of the group's Section Chief as Brian Gootee steps into his new role as AZGS Director and State Geologist.

Geohazards: The GeoHazards group has been busy with several projects. Earth Fissure mapping continued in Spring, 2026. Notably, we mapped a 4.4 mile long fissure with vertical offset of several feet just north of the Cochise County line (fissure is in Graham County). It is mostly running through center pivot fields but is visible between plowed fields, from the air, and is apparent in LiDAR data. Although this fissure is in Graham County the subsidence that produced it extends into Cochise County and we expect more of these to form given the similar geologic setting and rates of subsidence. We also updated fissure mapping in the Dragoon Road and Three Sisters Buttes study areas south of Willcox Playa. Both areas show ongoing subsidence and new and extended fissures were mapped in both areas. There is dramatic ongoing subsidence north of the Sulphur Hills and we anticipate fissure growth to continue, possibly during this monsoon season.

AZGS is working with the US Bureau of Reclamation to better understand slip rates and timing of the Carefree and Horseshoe faults in central Arizona. The fieldwork for this project is complete, although the analytical data is still being processed. We anticipate a final report out later this year.

Mapping for two landslide projects have also been completed. One project focused on identifying and mapping landslides along US Highway 60 between Florence Junction and Show Low, and the other focused on selected areas within Yavapai County. During mapping, over 750 new rockfalls, debris flows, and landslides and landslide complexes were identified. These will be added to the Natural Hazards in Arizona viewer, and a StoryMap with the Yavapai landslides will be released next month.

We continue our work with post-wildfire hazards. In June 2026, AZGS participated in a joint collaboration with the US Forest Service Rocky Mountain Research Station and the Agricultural Research Service to quantify hillslope erosion (specifically sediment yield) within the 2025 Greer Fire burn area near Greer, Arizona. The study site first burned in the 2011 Wallow

Fire, and the team is working to understand how sediment yield differs in areas that have burned once in recent years versus burning repeatedly within a relatively short time frame such as at the Greer Fire study site. Initial findings reveal that a year after the Greer Fire, some hillslopes within the reburned area are still producing significant sediment under varying rainfall and runoff conditions. This work allows for the team to take the first steps in updating hillslope erosion models for reburn conditions, which will be imperative for providing realistic sediment yield predictions to land managers when managing resources and public safety under future reburn events.

Data Science: Our research group continues to support the U.S. Geological Map Schema (GeMS) standards by delivering modernized digital mapping tools. We have updated our GeoMapMaker toolbar to ensure full compatibility with ArcGIS Pro 3.5 and 3.6. Alongside these updates, we are excited to announce the release of a brand-new, web-based Legend Generator Tool dedicated to generating presentation-ready, high-quality map legends, which can be accessed directly through our online tools portal.

In a landmark initiative for our group's data infrastructure portfolio, we have successfully completed the first six months of our three-year project to rebuild and migrate the Paleobiology Database from the University of Wisconsin-Madison to the University of Arizona. As the world's premier fossil repository, the database contains over 2 million documented fossil occurrences utilized globally by paleontologists and evolutionary biologists. Alongside this massive migration effort, our team is actively collaborating with the Energy Geology Group to refine and prepare increasingly robust, high-quality geothermal datasets for upcoming public release.

On the digital front, we are actively mitigating the loss of legacy ESRI StoryMaps that are no longer supported by launching a comprehensive effort to create entirely new, interactive StoryMaps. We look forward to rolling out these educational resources over the coming year to share our science in more dynamic and accessible formats.

Recent and upcoming AZGS outreach events:

- March 14-15, 2026: Ellie Broadman and Chad Kwiatkowski led the AZGS presentation on seismic hazards at the University of Arizona Festival of Books in the Science City.
- June 10, 2026: Al Neely presented at the monthly USGS landslide hazards seminar. Part of the presentation covered the Yavapai County landslide mapping project.
- June 19, 2026: Chad Kwiatkowski presented *Volcanism in Arizona* GeoTrivia at the Arizona Geological Society social at Corbetts, Tucson
- July 18, 2026: Ellie Broadman and Chad Kwiatkowski will be at the Monsoon Market at Tohono Chul to share information about the geology of the Santa Catalinas and Oro Valley, and earthquakes and active faults in Arizona.
- Sep 26 and 27, 2026: Chad Kwiatkowski will be at Science in the Park, at the Flagstaff Festival of Science, talking about earthquakes and active faults in northern Arizona. On the 27th he will lead a guided tour of faults around town in Flagstaff.
- Oct 15, 2026: And don't forget the Great Arizona ShakeOut which will be livestreamed from AZGS. We will post a link to the Great Arizona ShakeOut later this summer.

New AZGS Publications

Anderson, P., 2026. Precambrian Geologic Map of the Bradshaw Mountains, Battle Flat 7.5' Quadrangle, Central Arizona v. 2.0. AZGS DGM-285

Anderson, P., 2026. Precambrian Geologic Map of the Bradshaw Mountains, Battleship Butte 7.5' Quadrangle, Central Arizona v. 2.0. AZGS DGM-286

Anderson, P., 2026. Precambrian Geologic Map of the Bradshaw Mountains, Black Canyon City 7.5' Quadrangle, Central Arizona v. 2.0. AZGS DGM-291

Anderson, P., 2026. Precambrian Geologic Map of the Bradshaw Mountains, Bumble Bee 7.5' Quadrangle, Central Arizona v. 2.0. AZGS DGM-282

Anderson, P., 2026. Precambrian Geologic Map of the Bradshaw Mountains, Crown King 7.5' Quadrangle, Central Arizona v. 2.0. AZGS DGM-284

Anderson, P., 2026. Precambrian Geologic Map of the Bradshaw Mountains, Groom Creek 7.5' Quadrangle, Central Arizona v. 2.0. AZGS DGM-288

Anderson, P., 2026. Precambrian Geologic Map of the Bradshaw Mountains, Mayer 7.5' Quadrangle, Central Arizona v. 2.0. AZGS DGM-287

Anderson, P., 2026. Precambrian Geologic Map of the Bradshaw Mountains, Prescott 7.5' Quadrangle, Central Arizona v. 2.0. AZGS DGM-289

Anderson, P., 2026. Precambrian Geologic Map of the Bradshaw Mountains, Prescott Valley South 7.5' Quadrangle, Central Arizona

v. 2.0. AZGS DGM-290

Carey, Z.C. and Carey, N.J., 2026. Mineral Resources of Cochise County, Arizona. AZGS OFR-26-3

Currano, E.D., Contreras, D., Cleveland, C., Meredith, D., Moore, J., and Zaffos, A., 2026. PBot: Integrative Paleobotany Portal — How To Guide. AZGS OFR-26-9

Richard, S.M., 2026. Geologic Map of the Imperial Reservoir Quadrangle, Yuma County, Arizona and Imperial County, California v. 2.0: AZGS DGM-259

Richardson, C.A. and Carey, N.J., 2026. The Eric Seedorff Rock Sample Collection. AZGS OFR-26-5

Richardson, C.A., Carey, N. J., Silva, M.E., and Carey, Z.C., 2026. Whole-rock geochemical data for altered and mineralized samples from some major copper mines and deposits, Arizona and New Mexico. AZGS OFR-26-6

Richardson, C.A., Rezeau, H., Carey, N.J., Silva, M.E., Carey, Z.C., and Haxel, G.B., 2026. Late Cretaceous to early Paleogene ("Laramide") plutonic rocks and porphyry systems, Arizona. AZGS OFR-26-7

Spencer, J.E., 2026. Reconstruction of Cenozoic tectonic extension in the Sonoran Desert region and implications for porphyry copper exploration. AZGS OFR-26-8

Spencer, J.E., Johnson, B.J., Constenius, K.N., and Doe, M. F., 2026. Geologic map of the southeastern flank of the eastern Whipple Mountains, southeastern California. AZGS OFR-26-4

Zaitlin, L. and Thompson, L., 2026. Geochemistry Diagram Generator Web Tool v1.0: AZGS OFR-26-2

External AZGS Publications

In addition to our products that we directly publish and host within the Arizona Geological Survey Library (online), AZGS staff also publish work in journals and periodicals elsewhere. These publications can be related to AZGS projects, past research an individual was involved with, or ongoing side projects (AZGS staff bolded):

He, J.J., Crow, R.S., Douglass, J., Holm-Denoma, C.S., Vazquez, J.A., **Gootee, B.F.,** Lidzbarski, M.I., Pianowski, L.S., Gray, H., Heitmann, E., **Pearthree, P.A., House, P.K.**, and Dulin, S., 2026. Late Miocene Colorado River arrival in the Bidahochi basin supports spillover origin of Grand Canyon. *Science*, 392(6795), 289-295. doi:10.1126/science.adz6826

Holland, M.E. and Regan, S.P., 2026. The ghost of sutures past: A para-autochthonous origin for the Mazatzal crustal province in southwestern Laurentia demonstrated by structural, geochronologic, and isotopic analysis across the Yavapai-Mazatzal province boundary, central Arizona, USA. *Geosphere* 22(3), 458-483. doi:10.1130/GES02887.1

Thompson, L.A., Sjolund, A., Patterson, J., Wilson, T., and Wade, J., 2026. An inventory of surficial mafic rock resources for ex-situ carbon mineralization. I*nternational Journal of Greenhouse Gas Control* 153, 104663. doi:10.1016/j.ijggc.2026.104663

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