Front Matter

(Usually includes Dedication, President's Message, & Conference Organizer's Message.)

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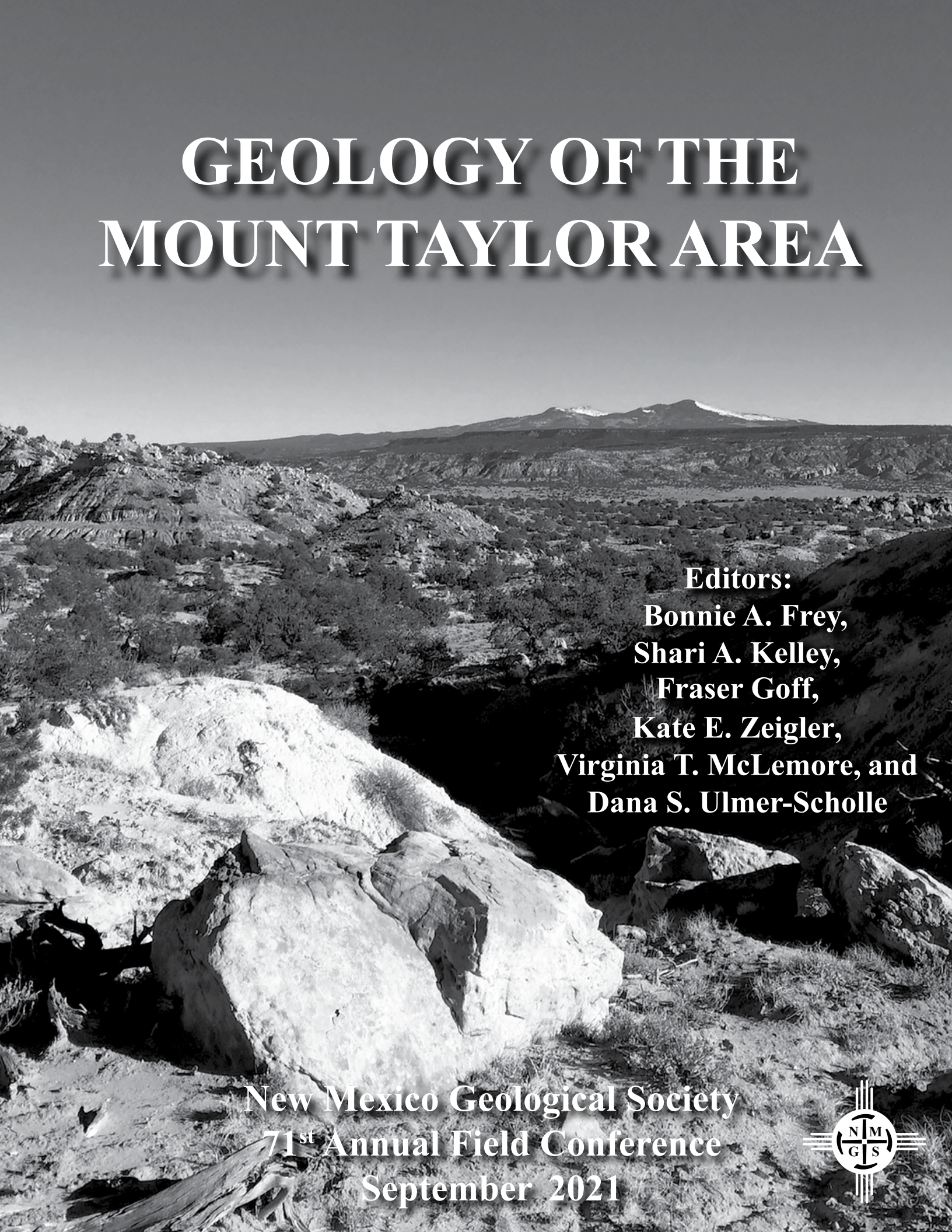
GEOLOGY OF THE MOUNT TAYLOR AREA



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New Mexico Geological Society
71st Annual Field Conference
September 2021

The New Mexico Geological Society is a tax-exempt corporation registered in the State of New Mexico that promotes interest in geology and associated sciences, fosters scientific research and publications, encourages cooperation among its members, and stimulates interest in New Mexico geology. These goals are met through annual fall field conferences held in different locations in New Mexico or adjoining states and annual spring meetings, generally held in Socorro, New Mexico, where oral and poster presentations on different aspects of New Mexico geology are given.

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DEDICATION

We gratefully dedicate this guidebook about the geology of the Mt. Taylor area to the Pueblo of Laguna. The Pueblo has supported and participated in both geologic and environmental research in and around Mt. Taylor and Jackpile Mine. Mt. Taylor is an important cultural site to the Laguna community. In addition, the Pueblo has been impacted by mining activities associated with uranium extraction in the area, including at Jackpile Mine.

The Pueblo of Laguna has been working with the New Mexico Bureau of Geology and Mineral Resources' mapping program for over a decade. Pueblo approval to access Laguna lands has facilitated the production of six STATEMAP geologic quadrangle maps. These maps were used to compile a geologic map of the Mt. Taylor volcano, one of the featured works of the 2021 field conference.

The Laguna Environmental & Natural Resources Department (ENRD) also worked closely with several undergraduate and graduate students from New Mexico universities, whose studies focused on uranium mobility and the impact of mining activities at sites such as the Jackpile Mine in northern Laguna Pueblo. ENRD provided escorts, logistics, and site assistance to more than 10 university students and professionals who were participating in "Energize New Mexico," an NSF program dedicated to investigating energy industries that are not carbon emitters. This group of studies was preceded by NMT soil and plant studies in the early 2000s and will continue with UNM and NMT health studies.

This research direction is indicative of the change in perspective toward mining that Laguna Pueblo has seen in the last one hundred years, from the 1950s "uranium capital of the world" to the modern focus on identifying hazards, remediating sites, and mitigating health effects, a focus described in McLemore et al. (this volume). Mining provided jobs for thousands in McKinley and Cibola counties, including members of the Laguna tribe. Mining also affected the health of citizens within the local communities.

Their strong affinity with Mt. Taylor, located only about 20 miles from the pueblo, is shared with many indigenous cultures, serving as a spiritual site and for hunting, grazing, farming, and collecting resources. Laguna Pueblo supported what became the successful 2008 designation of Mt. Taylor as a Traditional Cultural Property, when the mountain became eligible for listing on the National Register of Historic Places.

Thanks to the Pueblo of Laguna for its dedication to this landscape and for their partnerships with the many groups working in the area.

The editors

NEW MEXICO GEOLOGICAL SOCIETY FOUNDATION

The New Mexico Geological Society (NMGS) Foundation was established in 2003 with the mission of providing a source of funding for educational, and scientific objectives, which benefit the geologic profession in New Mexico and the general public. The NMGS has a distinguished history as one of the premier state geologic organizations in the country, dating to its founding 73 years ago in 1947. One of the primary attributes, that differentiates the NMGS from many state geological societies, is the ready access to world-class geologic outcrops and the effort to get young geoscience students out of the classroom and into this natural laboratory to gain hands-on experience during the annual Fall Field Conferences. NMGS Fall Field Conference organizers and presenters are at the forefront of their geoscience fields and use the latest technologies and applications that optimize students learning experiences and broaden their educational experience.

The NMGS Foundation was created as a Non Profit Organization (501(c)(3) Corporation) whose revenues are responsible for supporting activities that include the annual NMGS Fall Field Trip, NMGS Spring Meeting, numerous NMGS Grants-in-Aid to students undertaking geological research in the state of New Mexico, and scholarships to students attending 4-year colleges and research universities throughout New Mexico.

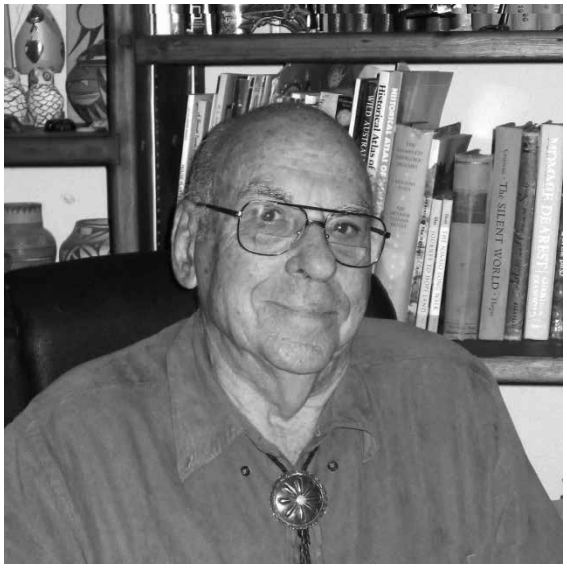
The objective of ensuring student participation in NMGS annual field trips and research events will continue the legacy of NMGS events as a premier nationwide destination for education in the geosciences. In that spirit, we invite you to join us in supporting the NMGS with a philanthropic gift. You can go https://nmgs.nmt.edu/donations to make your gift.

MEMORIAL

William (*Bill*) Lyman Chenoweth

In this volume, that features a location deep in uranium country, we memorialize one of the giants of uranium geology and a 66-year member of the New Mexico Geological Society (NMGS).

We remember Bill Chenoweth, who died in 2018, as the guy to go to if someone needed to know anything about uranium in the Western United States. Bill had a long career in the uranium industry, beginning as a student in New Mexico and culminating with nearly two decades working with the U.S. Atomic Energy Commission (AEC). He chaired the Nuclear Minerals Committee of the Energy Minerals Division of the American Association of Petroleum Geologists from 1983 to 1998 and spent his later years as a consultant to the Justice Department on the Radiation Exposure Compensation Act. His incredible memory for details and his meticulous record keeping were an invaluable resource to families of miners seeking compensation for radiation-related illnesses.



Bill received his bachelor's degree in geology from Wichita State University in 1951 and, while a student there, attended a summer field camp in the Zuni Mountains sponsored by the New Mexico School of Mines (now New Mexico Institute of Mining and Technology). After seeing New Mexico's geology, he decided to enroll in graduate school at the University of New Mexico, where he received a master's degree in geology in 1953. His thesis focused on the Morrison Formation in the southeastern part of the San Juan Basin, Valencia County, New Mexico – his first work funded by the AEC. After graduation, he worked on AEC uranium exploration drilling projects on, what was then called, the Navajo Indian Reservation, in northeastern Arizona and northwestern New Mexico, studying area uranium ore deposits for the next 11 years.

An added benefit of working in northwestern New Mexico was meeting his wife, Miriam (Polly) Pawlicki. They met in 1954 while she was the head nurse at the Indian Service Hospital in Shiprock, New Mexico. They were married on January 6, 1955, at Christ the King Mission in Shiprock. Their children, Mary and Martin, were born in Farmington, Peter in Flagstaff, and Paul in Grants.

In 1964, Bill was transferred from Grants to the AEC's main office in Grand Junction, Colorado. Although he was assigned to study uranium ore deposits in South Dakota and Wyoming, he continued to work on uranium deposits in New Mexico. Bill was appointed chief of the Geologic Branch in the Grand Junction office in 1970, responsible for the activities of the AEC geologists in the 14 western states. During this time, he examined all the major uranium mining areas in the United States. In 1983, his job was moved to Washington, D.C., by the Department of Energy. Rather than relocate, Bill began consulting and became a research associate at the New Mexico Bureau of Geology and Mineral Resources (NMBGMR), providing many unpublished mining records to the Bureau's mining archives and working with staff to compile the uranium mines databases now used by state and federal agencies.

Bill passed away in Grand Junction on July 23, 2018, at age 89. His legacy was extraordinary. He authored and co-authored more than 80 reports on uranium mining history, geology and resources in New Mexico, Arizona, Colorado and Utah. His most recent report – Uranium Resources, Volume C of Energy and Mineral Deposits in New Mexico, published as NMBGMR Memoir 50 and NMGS Special Publication 13 – won the 2018 Charles J. Mankin Memorial Award of the Association of American State Geologists). In 2019, Bill received a special tribute in a temporary historical photo exhibit in Grand Junction, where he had been secretary/treasurer of the Grand Junction Geological Society at the time of his passing. The exhibit marked the 75-year anniversary of that area's contribution to the Manhattan Project and the Cold War and recognized Bill for his research into the DOE's history in Grand Junction. Bill was inducted into the New Mexico Mining Association Hall of Fame on Sept. 5, 2019.

Virginia T. McLemore, NMBGMR

PRESIDENT'S MESSAGE

Welcome to the Mt. Taylor area and the 71st NMGS Fall Field Conference! We are fortunate in so many ways to be here together: fortunate to live in a state as beautiful and geologically diverse as New Mexico, fortunate to be part of a thriving Geological Society that is built on over 70 years of generous contributions from generations of brilliant and dedicated geoscientists, and fortunate to be seeing one another face to face again after a year of isolation. I am overwhelmed with gratitude as I write this.

I want to express deepest thanks to the conference organizers, led by Bonnie Frey and Shari Kelley. Beyond the usual efforts of planning field trip stops, organizing speakers, and editing papers, they have had to continuously modify their plans for this conference in the ever-changing world of the pandemic. Countless contingencies have been planned. Risks have been weighed. Innumerable roadblocks have been overcome. And they have done it all with an inspiring level of grace and patience.

Many others have risen to the challenges of the past year. Susan Lucas Kamat and Diane Agnew organized both the 2020 NMGS business meeting and the 2021 Spring Meeting, held via Zoom. Their planning and hosting created an event that had abundant and authentic interactions and crisp organization, more so than any on-line conference I experienced in this long year. Our webmaster, Adam Read, has made our catalog of publications available electronically on our website and maintained communication with the society's membership. Connie Apache has continued to oversee our business operations and keep the ship running, even as offices and bank lobbies closed. Dana Ulmer-Scholle was accommodating and flexible in her role as managing editor of this volume, helping us to publish the scientific research articles as a Special Publication in 2020, and then combining them back in with the road logs and updates in this traditional Guidebook.

The NMGS Foundation board members have been careful stewards of our financial resources, and enabled us to continue providing grants and scholarships to student researchers throughout the state without disruption: approximately $35,000 in 2020 and $53,000 in 2021. At the initiative of Scholarship Committee Chair Susan Lucas Kamat, the Pipkin Book Scholarships have been expanded to include all 2-year colleges with geoscience programs, including Navajo Tech, San Juan College, SIPI, Mesalands, NMSU-Grants and UNM-Taos, not to mention all the schools that we have historically supported.

It has been a privilege to serve on the NMGS executive committee. I am so thankful for my fellow committee members and the relationships I have formed with these talented and generous individuals. I strongly encourage each of you reading this to consider volunteering for the executive committee or any of the ancillary committees and conference organizing teams that keep the New Mexico Geological Society vibrant and growing. There are few geological organizations like this in the country! Please pull me or any of the executive committee members aside, and we would be delighted to help you find the right role.

So, let's raise our glasses to an ever-deepened appreciation of being together on the outcrop at the legendary NMGS Fall Field Conference!

Daniel Cadol
2021 NMGS President

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CONFERENCE ORGANIZERS' MESSAGE

We are so very grateful to be able to offer the 2021 field conference. After more than a year of uncertainty, and several more years of planning, we share the work we have done in the Mt. Taylor area.

As planned, but with revisions, the conference will start on the west side of Mt. Taylor for an introduction to the regional stratigraphy, starting in the Upper Triassic and ending in the Upper Cretaceous, on Day 1. On Day 2, we will visit the forested Water Canyon to view the volcanic rocks in the Amphitheater of Mt. Taylor. We end on the east side of Mt. Taylor where we will take a closer look at the Morrison, Dakota and Mancos stratigraphy and their role in the legacy of the important uranium deposits in the area.

We have so many people to thank. We start with the land owners, particularly the Pueblo of Laguna and Cebolleta Land Grant, who so kindly gave us access to their land. We also thank our vendors, who overcame staff shortages and limited food availability to feed us. Fraser Goff, along with Rick Kelley, stepped forward to help recreate our plans for Day 3 when our original plans became untenable. Dana Ulmer-Scholle helped us get the guidebook printed despite many delays in our plans. Many thanks to Connie Apache and Adam Read, as always offering a stable team to guide us through the registration process. Connie also worked with Ginger McLemore to bring institutional memory to the drink truck, with new instructions from the NMGS Executive Committee and COVID advisory panel added to this already complicated task. That said, we hope you will join us in thanking a group of people who offered their guidance to help us plan an in-person conference, our COVID advisory panel: Scott Baldridge, Dan Cadol, Ginger McLemore and Kate Zeigler. Although Susan Lucas-Kumat was not a member of the committee, she offered invaluable advice and helped final checks of the Day 3 road log. Phil Miller created the beautiful simplified version of the Mt. Taylor map for the inside cover of the guidebook and the t-shirts. We thank the New Mexico Bureau of Geology for permission to use this image. Spencer Lucas, Brian Hampton and Steve Cather were available for last minute guidance regarding some of the stratigraphy still under debate in the area.

Most especially we would like to thank you, our conference attendees and NMGS members, who stuck with us through all our tenuous plans. We hope you enjoy this guidebook and most of all a chance to explore the beautiful geologic setting of Mt. Taylor.

Bonnie Frey and Shari Kelley