The Harding Pegmatite Mine Safeguard Project

Dixon, New Mexico
June 2013

Submitted for a NAAMLP Abandoned Mine Land Reclamation Award by:

New Mexico Abandoned Mine Land Program
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Construction Start: June 28, 2011
Construction Completion: August 18, 2011
Final Construction Cost: $206,697

Bat Consultant: Dr. J. Scott Altenbach, University of New Mexico (Ret.)
Archaeological Consultant: Office of Archaeological Studies,
NM Department of Cultural Affairs

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Stope #1 Closure at the Harding Pegmatite Mine (Aug. 2012)

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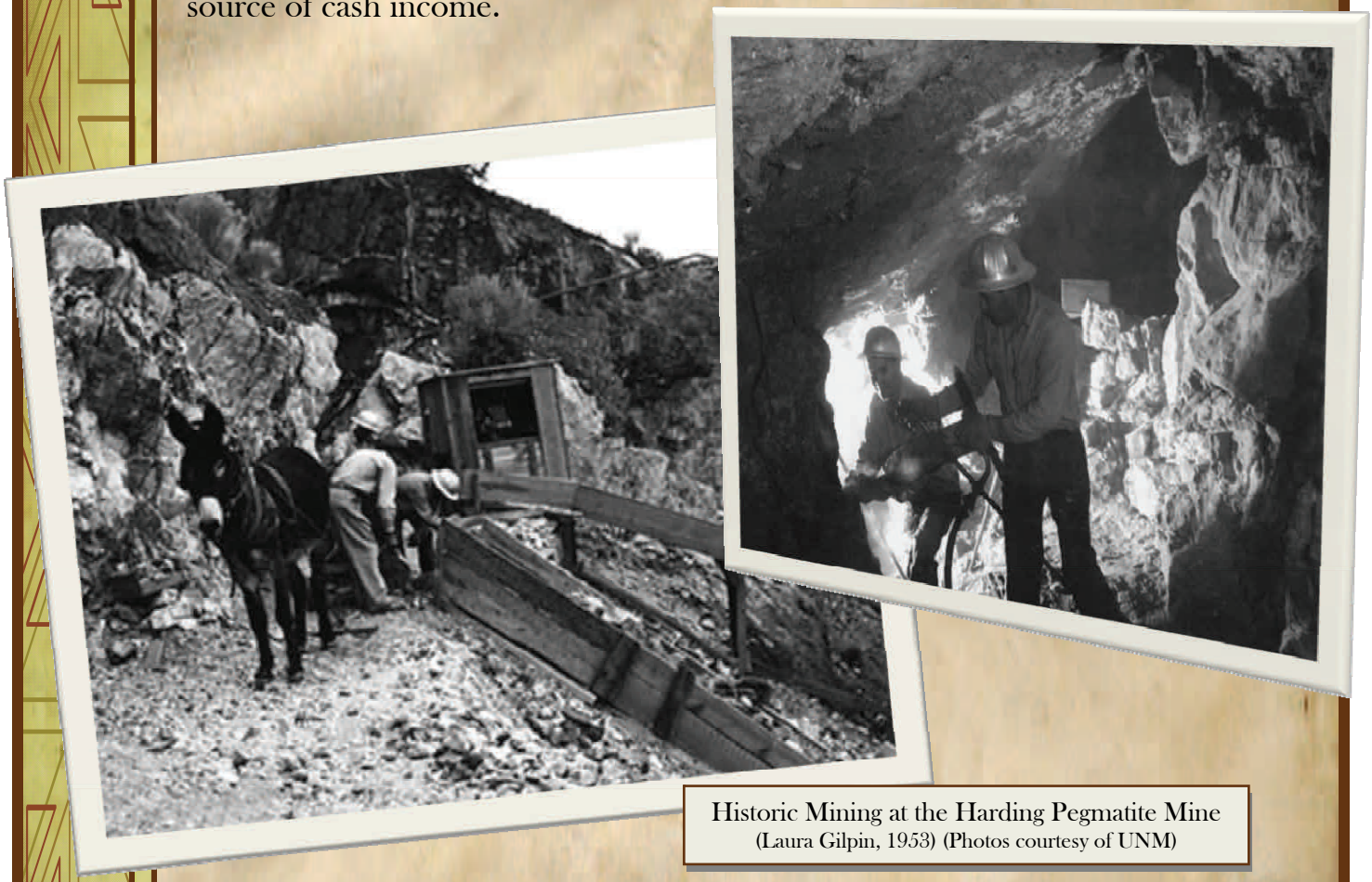
THE MINE SITE:
ITS HISTORY AND MINERALOGICAL IMPORTANCE

The Harding Pegmatite Mine, situated five miles east of Dixon in north-central New Mexico, is a historic and geologic treasure that has made significant contribution to the scientific understanding of the origin of pegmatites and associated mineral resources. A pegmatite is an exceptionally coarse-grained igneous rock, with interlocking crystals, usually found as irregular dikes, lenses, or veins.

For over 40 years, starting in the early 1900s and especially during World War II, the pegmatites at the mine were a source of economically and strategically important minerals for the United States of America. The tantalum-bearing mineral microlite was associated with lepidolite at the Harding Mine and between 1942 and 1947 the mine was the world's largest producer of this mineral, needed to manufacture walkie-talkies and radios for the armed services. Other strategically important minerals mined at the site include beryl (used to make non-sparking tools needed in the development of atomic weapons at the nearby Los Alamos National Laboratory), spodumene (a lithium mineral used for ceramics and compounds used in thermonuclear bombs) and optical grade calcite. While the mine was active, it gave many local families a much needed source of cash income.



Historic Mining at the Harding Pegmatite Mine
(Laura Gilpin, 1953) (Photos courtesy of UNM)

When mining activities at the Harding Pegmatite Mine ceased in the 1950s, it left a remarkably well preserved and exposed pegmatite that is used today as an outdoor laboratory for geology and mineralogy students from around the world and as a site for public mineral collecting. In 1978, Dr. Arthur Montgomery, the mine's owner, donated this world class mine to the Department of Earth and Planetary Sciences at the University of New Mexico (UNM). It has remained under UNM's supervision since then. Three to four thousand people, including touring geology and mineralogy professors and students and busloads of school children, visit the site each year. More information on the mine can be found at http://epswww.unm.edu/harding/harding.htm.

THE PROJECT:

Given the high visitation rate and the presence of ten hazardous abandoned mine openings, UNM was interested in better controlling access to the site and underground mine workings. During project development, the New Mexico Abandoned Mine Land (AML) Program held a public meeting in the nearby town of Dixon to gather public comment. All comments received indicated broad community support for the project, as long as the site remained open to the public. The project was funded through a grant from the Office of Surface Mining and Reclamation Enforcement, Department of the Interior.

Adit #2 after Construction (Feb. 2012)
(Note the pegmatitic crystallization around the mine opening)

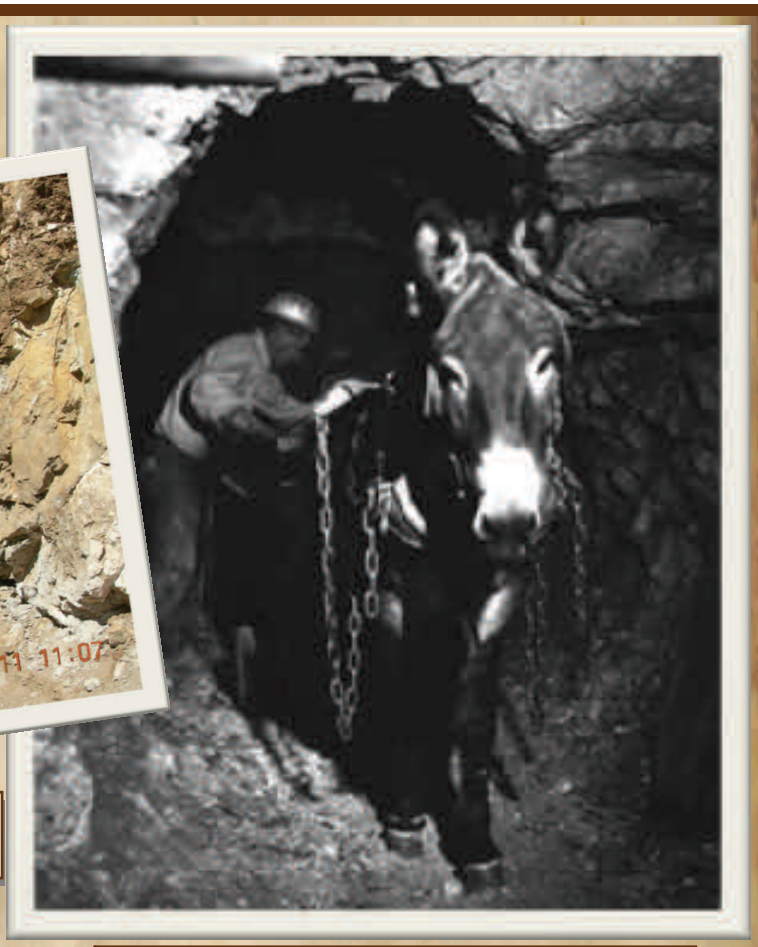
Adit #2 before Construction (May 2008)

Consultation with the UNM Department of Earth and Planetary Sciences and the site caretaker led to the following project elements:

- Improvement of site access control by installing a post and chain barrier around the parking lot, installing a heavy-duty locking hinged swing gate at the entrance road leading from the parking area, and constructing a chain gate across a secondary access road.
- Backfilling of one mine shaft using mine waste rock.
- Construction of bat grates, each with a hinged locking door, at five adits.
- Construction of bat grates, without hinged doors, at one stope and two adits.
- Construction of a corrugated steel pipe (culvert) airflow closure at one adit.
- Installation of a six strand barbed wire fence along a highwall.
- Installation of two interpretive sign bases and signs. UNM and the AML Program worked together to develop the format and content of the interpretive signs, which includes the roles of the AML Program and the Office of Surface Mining in the project. Site history, photographs, and mineralogy are highlighted.
- Installation of seven numbered marker posts to be used by visitors as markers for an informational self-guided tour brochure.

Adit #1 after Construction (Feb. 2012 left and Aug. 2011 right)
(Note the bat compatible horizontal openings in the hinged door)

Adit #3 after Construction (Aug. 2011)
(Note bat compatible and small mammal access openings)



Historic Mining at the Harding Pegmatite Mine
(Laura Gilpin, 1953) (Photo courtesy of UNM)

DESIGN CHALLENGES:

Over several months, AML Program engineers developed the mine safeguard project design, meeting and solving numerous design challenges. As you will see, some of these challenges required special consideration.

First, UNM required that many of the underground workings remain accessible to authorized personnel for scientific training and research purposes. Access is needed on a fairly regular basis and often by elderly personnel, so crawling through removable bars was not a desired means of entry. To meet this requirement, the AML project engineer designed lockable hinged doors at all adit portals where access is needed. All adits that could be used as an

Adit #2 during Construction (July 2011)
(Note locking framework against rock profile before grout fill)

Stope #1 before Construction (Apr. 2010)

Stope #1 after Construction (Aug. 2011)

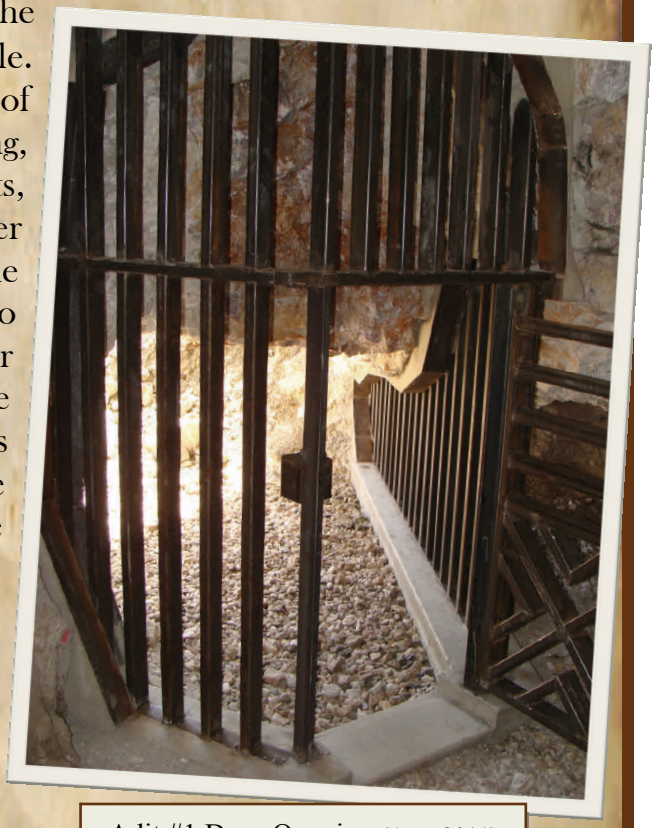
emergency escape route from other locations inside the mine were also equipped with lockable hinged doors. Doors were designed to be as tall as practicable with walkable access where possible.

Stope #1 after Construction (Aug. 2011)

In the event of a cave-in or other mine disaster, people inside the mine could be blocked from getting out of the workings through other mine openings if connecting adits that provided alternate escape routes were grated shut. A system had to be devised that would allow geologists and mine explorers to escape through other mine openings without getting trapped. The project engineer solved this safety hazard through design of an innovative and effective locking mechanism that could be opened from the inside without a key. The opening mechanism is not accessible from the outside and includes a ball hitch as the only moving part and one that cannot be lost or

broken. All doors that can be used as an alternate escape route are equipped with this unlocking mechanism, eliminating a significant safety concern.

Secondly, the bedrock at most of the mine openings was very hard, but brittle. There were also very dangerous roof conditions. This made percussive drilling, needed to install anchor bars or roof bolts, both hazardous and difficult. A safer method had to be devised to secure the grated closures to the adit openings. To solve this challenge, the project engineer designed the grating with both an inside and outside framework that closely follows the existing rock wall contour around the perimeter of the opening and locks the grating in place. Also, extra wide concrete footers were used to give the grating a very stable base.



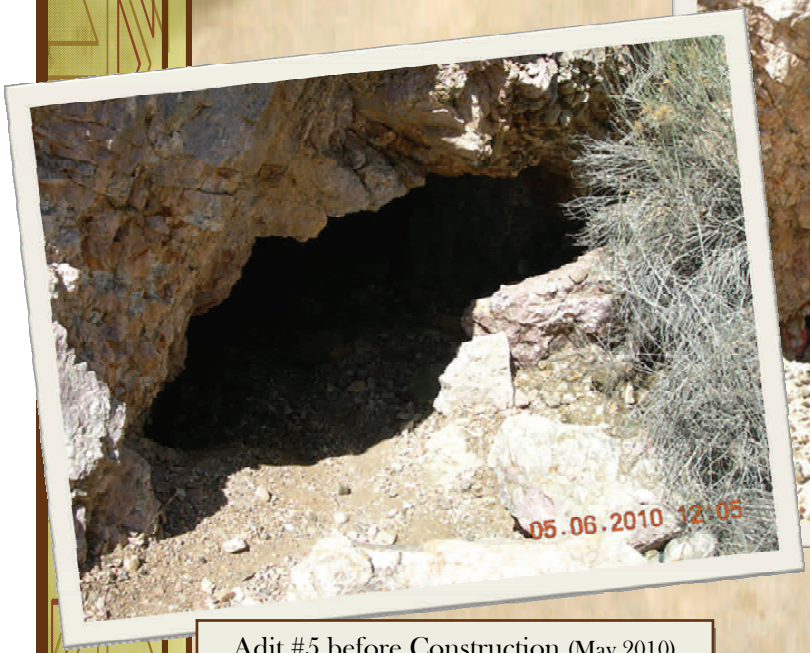
Adit #1 Door Opening (Aug. 2011)

Designs also needed to minimize the visual impact on this historic site and, where feasible, to enhance the visitor experience. All closures were designed to be both aesthetic and functional, while being located to reduce the visual impact as much as practicable. Exposed steel used in the project is corrosion-resistant weathering steel which forms a reddish-brown patina that blends well into the setting. Additionally, the closures were designed and located so as to not hide any significant geologic features (large crystals, contacts between different minerals etc.) that are often located near the mine openings. UNM also requested that the closures be designed to allow the general public views into the mine workings while restricting them to a relatively safe location near the mine opening.

Since the mine provides significant bat habitat, all hinged doors in the grated closures were designed with several 5¾" high horizontal openings that allow bats to pass through while restricting human access. Small mammal access is also provided in all grated closures, either between the vertical bars or through special 8" square openings. Closures were designed to minimize restrictions to natural ventilation, which is important to both the bat population and other wildlife and human visitors to the underground workings.

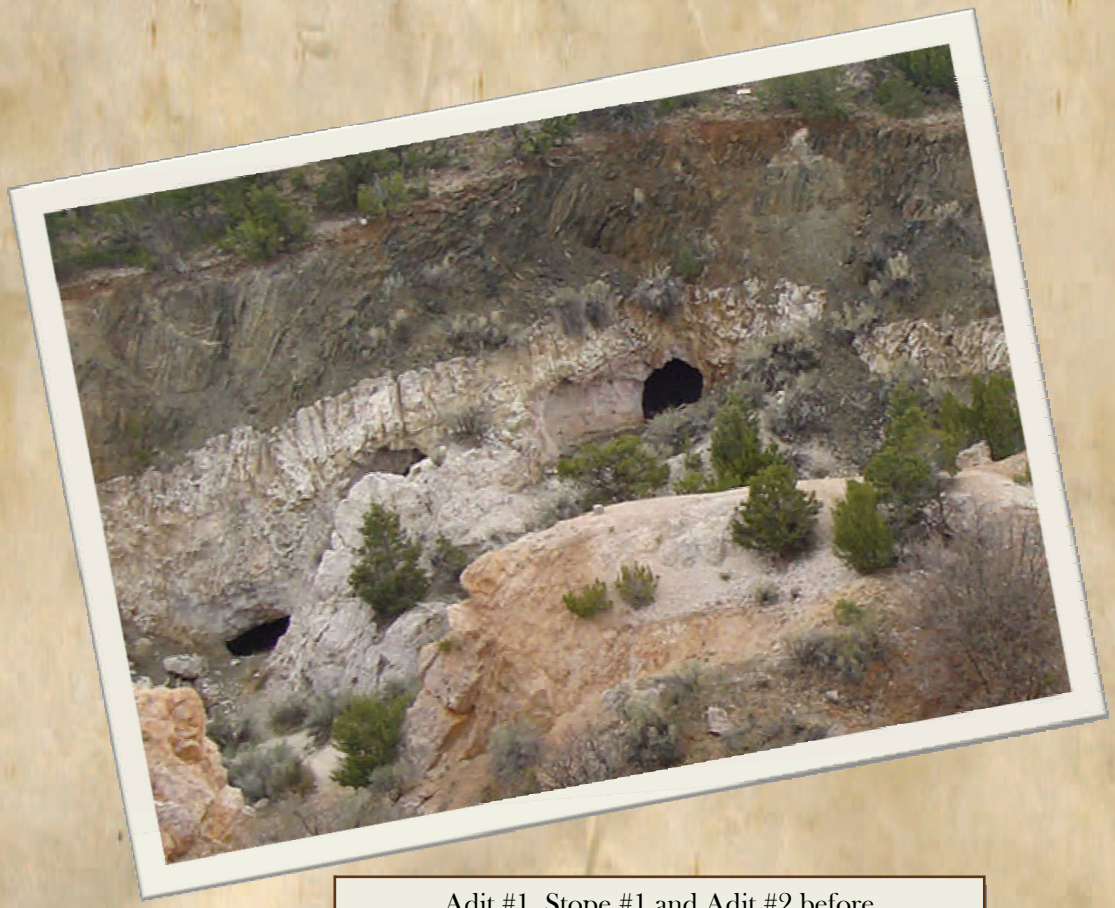
Lastly, both UNM and the AML Program were concerned about trespass and vandalism. Therefore, closures and other structures were designed to be strong and reasonably vandal and bullet resistant. Susceptible components such as hinges and locks were designed to be robust and protected. Hinge and doorframe designs were devised to hide the hinges and make them almost impossible to tamper with from the outside.

A Bus-load of Geology Students Shows Up during Construction (June 2011)
(This highwall was fenced later during construction)



Adit #5 before Construction (May 2010)

Adit #5 after Construction (Aug. 2011)
(With bat compatible openings in hinged door)



Adit #1, Stope #1 and Adit #2 before
& after Construction (May 2010 above & Aug. 2011 below)
Note that one project objective was to minimize site disturbance

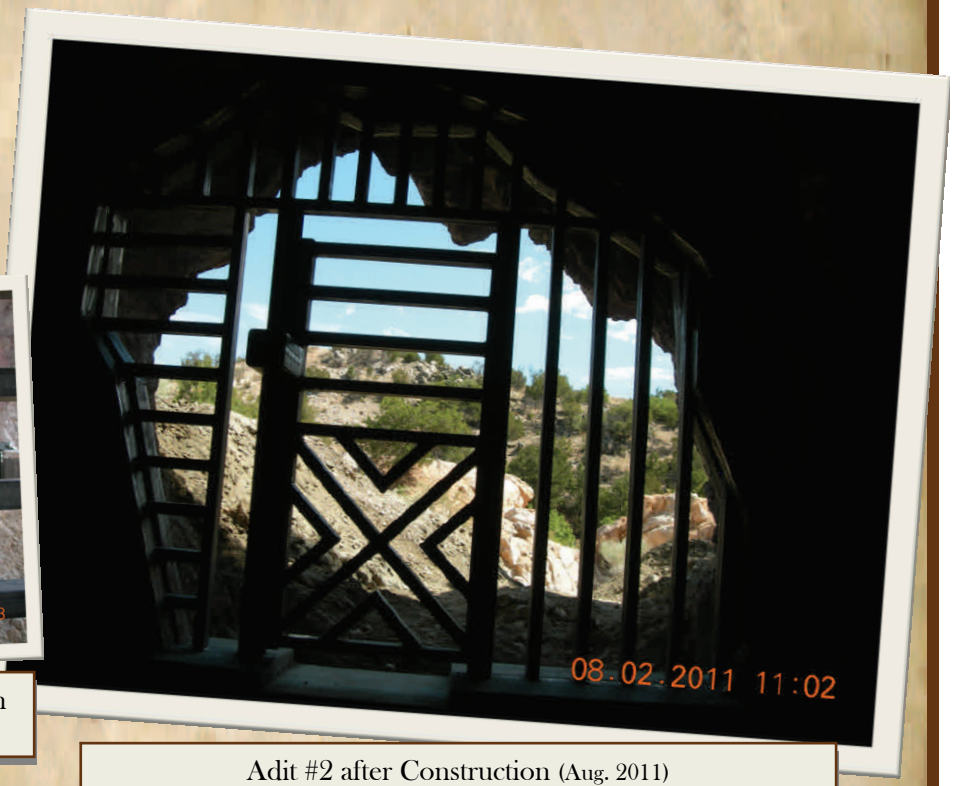
SUMMARY

This is an award-worthy project that met difficult design challenges, the expectations and requirements of the land owner, State Historic Preservation Division and local citizens, and the need for improved public safety at a highly visited abandoned mine site, while respecting the Harding Pegmatite Mine's unique historic, geologic and mineralogic significance. Minimizing alteration of the area, the use of attractive grate designs that allow visitors to view much of the underground mine workings, and the installation of interpretive signs all serve to increase the quality of the visitor experience, at the same time allowing for controlled access to the unique geology found in the underground workings.

The distinctive door, hinge, and lock designs developed for this project can be used in future abandoned mine projects wherever restricted access to underground mine openings is desired. Also the NM AML Program continues to use similar designs as those used in this project for bat and small mammal access to mine workings. (Contact the Program for engineering drawings or download them from http://www.emnrd.state.nm.us/MMD/AML/AML-HardingPegmatite.html.)

Most importantly, completion of the project gives the University of New Mexico an enhanced ability to control access to both the site and the mine workings, while greatly improving the safety of visitors, including scientists, students, mineral enthusiasts and school children.

Close-up of Unlocking Mechanism
(Aug. 2011)

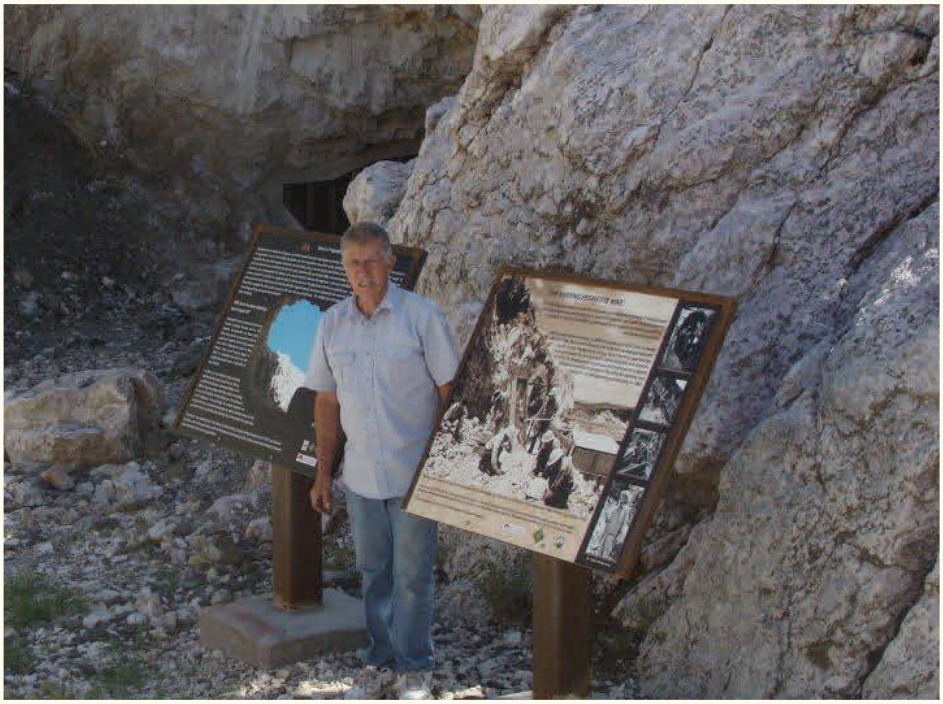


Adit #2 after Construction (Aug. 2011)
((Note bat compatible openings and unlocking mechanism at hinged door)

Adit #1 before Construction (Aug. 2009)

Adit #1 during Construction (July 2011)

Adit #1 after Construction (Aug. 2011)



Interpretive Signs Installed at the Site (May 2012)

New Main Gate Entrance and Parking Area
(Feb. 2012) (With Gilbert Griego, Site Caretaker)

COPY OF EMAIL FROM UNM

From: Adrian Brearley <brearley@unm.edu>
Sent: Sunday, August 05, 2012 5:30 PM
To: Kretzmann, John, EMNRD; Guranich, John, EMNRD; Rodarte, Raymond, EMNRD
Cc: Gilbert Griego
Subject: Safety improvements at the Harding Pegmatite mine.

Dear John, John, and Raymond,

On behalf of the University of New Mexico and the Department of Earth and Planetary Sciences, I wanted to thank you for the great efforts you have put in to the many safety improvements at the Harding pegmatite mine, near Dixon, New Mexico. I visited the mine in October last year when Gilbert Griego, our mine caretaker, showed me around all the upgrades. I was exceptionally impressed by the very high quality of the work and the attention to detail. The mine is now a vastly safer place than it was before, making Gilbert's job much more straightforward and certainly much less worrisome, now that the tunnel entrances are secured. In particular, the installation of gates to the roads that lead to the rear of the property will prevent unauthorized access to the mine, a serious problem for Gilbert in the past. This addition will also significantly reduce the loss of materials from the mine caused by unauthorized collectors.

The new informational signs are also a wonderful addition to the mine and will undoubtedly increase the enjoyment of the many mineral enthusiasts and school children that visit the mine each year. The list of improvements just goes on and on and it would be remiss for me not to mention the expansion of the parking lot to accommodate buses and the installation of the very substantial chain fence. The parking lot was in major need of renovation but with the constraints on the UNM budget it is highly unlikely this would have occurred in any reasonable time frame. So your initiative to secure funding for the upgrades to the mine from the state and including this aspect of the mine renovation in the budget is immensely important.

I also wanted to say that I greatly appreciate your willingness to accommodate Gilbert's suggestions to improve the original design of the tunnel entrance gates. I understand from Gilbert that you really worked very closely with him and made many adjustments in the plans to meet his requirements.

I see this as a significant milestone in the history of the mine that will help preserve the mine as an important educational resource for New Mexicans and our visitors from elsewhere in the US and indeed from around world.

Many thanks to you all, once again.

Best regards,

Adrian Brearley
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