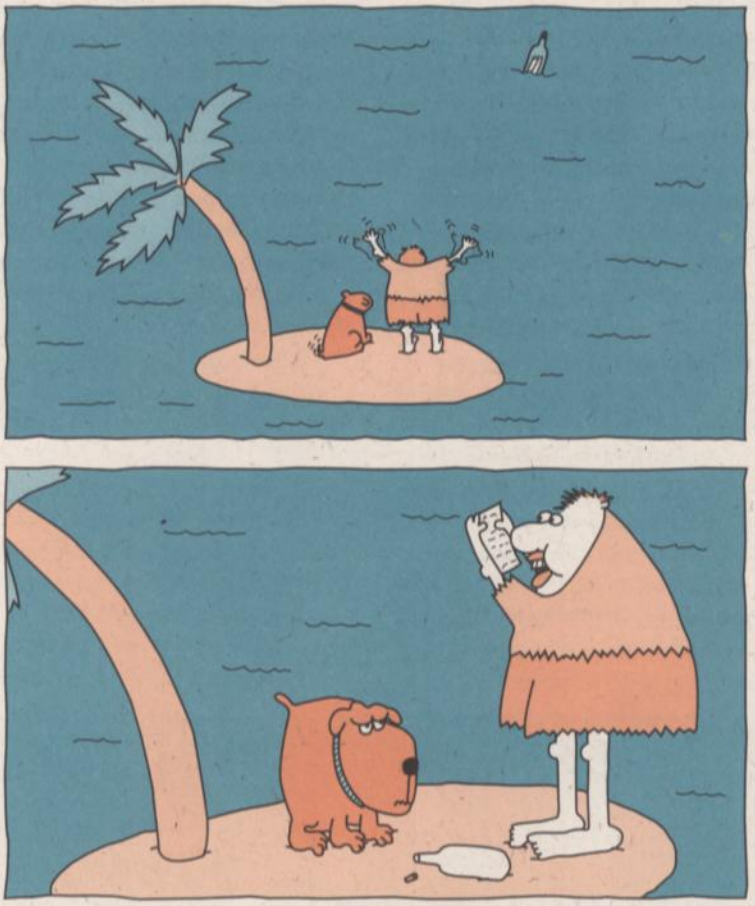
Number 19
1998

# LITE geology

A publication for educators and the public–
contemporary geological topics, issues and events

New Mexico Bureau
of
Mines and Mineral
Resources
a division of New Mexico Tech



"Well look here! It says we won an all expense paid vacation for two to a remote island paradise."

## This Issue



## Earth Briefs

### Beachcombing in the desert

**Nelia W. Dunbar**
*Geochemist*
NMBM&MR

Although people usually think of beach combing on ocean beaches, the banks of rivers can harbor treasures too. In 1985, a new Regent Hotel opened in Sydney, Australia. In order to celebrate this opening, Regent Hotels around the world, including one in Albuquerque, New Mexico, launched messages in bottles into their nearest waterways. For the Albuquerque hotel, this was the Rio Grande.

In late spring, 1986, while riding horses along a sandbar on the banks of the Rio Grande near Socorro, New Mexico, Bill McIntosh and I spotted a heavy-looking green champagne bottle partly buried in sand. We could see that the bottle was unbroken, and that there was something inside. So, we stopped the horses, and got off to investigate. The bottle contained a neat-looking scroll of paper, sealed with red wax! We quickly opened the bottle, and extracted the following message:

*On this day in Sydney Australia, a Grand International Hotel was declared open.*

*Champagne flowed.*

*And the sounds of celebration flowed out across Sydney Harbour, through the heads, and onto the Pacific Ocean.*

*On that date, each Regent Hotel in the world launched a message in a bottle.*

*They were cast adrift upon the mercies of three oceans and a thousand*

*capricious currents.*

*Fate has decreed that you should find this bottle.*

*The Regent has decreed that your reward should be wonderful.*

*Write to Miss Sonia Smirnow*
*The Regent Hotel, 199 George Street, Sydney*
*NSW, Australia 2000.*

Well, with visions of trips to Australia dancing in our heads, we mailed off a letter to Sonia Smirnow. Soon, we received a call from the Regent Hotel in Albuquerque, inviting us to come up to claim our reward. Once there, we had a nice visit with hotel officials, and were each given bottles of Australian wine, Australian macadamia nuts, and Regent bathrobes. Not quite a trip to Australia, but much appreciated anyway!

The bottle that we found had traveled around 120 km downstream from Albuquerque to Socorro (see location map, Fig. 1, below). The bottle was found on a vegetated sandbar, so it must have been deposited when the river was above its normal level. But, we know that the bottle wasn't deposited during a major flood, such as that which formed the Rio Grande pumice deposits discussed in this issue. We didn't have to use any high-tech methods to determine the age of the bottle, because unlike the pumice in the Rio Grande flood deposits, the message in the bottle was printed with a date. We found the bottle about 1 year after it had been launched, but don't know how much of that time the bottle had spent traveling down the river, or for how long it had been on the sandbar before we found it. We are currently investigating how many Regent Hotel bottles were launched around the world, how many were found, and how far they traveled. The results of our search will be revealed in a future issue of Lite Geology.

# Born of fire and water: Ancient flooding of the Rio Grande

**Steven M. Cather**
*Sr. Field Geologist*
NMBM&MR

Reporters covering the news try to supply answers to the classic questions: *Who? Where? What? When? How?* and *Why*? With the exception of *who*, which doesn't apply to rocks, geologists attempt to answer these same questions, but based on sketchy and often incomplete evidence from the ancient past. Using high-tech tools and scientific reasoning, geologists piece together ancient sequences of events, much like a detective at the scene of a crime.

Just east of the small town of San Antonio (Fig. 1), in central New Mexico about 12 miles south of Socorro, some very unusual rocks form gray bluffs along the east side of the Rio Grande valley. Found only in an area about the size of a football field, these rocks are sedimentary in origin, having been deposited long

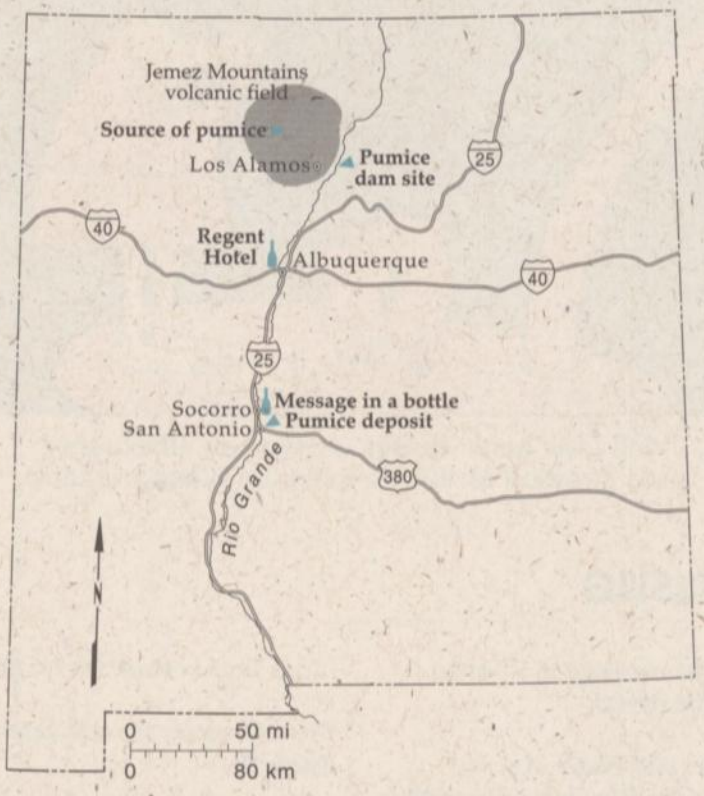



Figure 1—Map of New Mexico showing source and deposition sites of Rio Grande pumice and message bottle (see cover story).

ago by flooding along the ancient Rio Grande. The deposit is unusual because it contains fine volcanic ash and pieces of pumice that do not match any of the other volcanic rocks of the region. The pumice is a froth of volcanic glass that is so full of air holes that pieces will actually float on water. Some of the pumice pieces in this ancient flood deposit are quite large, forming rounded cobbles as much as one foot in diameter (Fig. 2). Early settlers in the San Antonio area recognized the uniqueness of these pumice pieces, and drove their wagons from miles around to collect the pumice that they soaked in kerosene to use as fire-starters in their coal-burning stoves. More recently, the coarse pumice has been mined and used to produce stone-washed denim fabric.

Although geologists have studied this unusual deposit for nearly a hundred years, only during the past few years has it begun to be understood. By comparison with modern deposits from other areas, we know that a large flood deposited the ash and coarse pumice. We also know that the chemical and physical characteristics of the volcanic ash and pumice do not match any nearby sources, but are a perfect match for some of the rocks erupted from the giant volcanic system that now forms the Jemez Mountains, 130 miles away in northern New Mexico. But, as scientists, we want to know more. For example, when did the flood occur? What caused it? Which of the many volcanic eruptions in the Jemez Mountains produced the pumice? What relationship, if any, existed between the eruption and the flood? To answer these questions we must turn to high-tech methods.

Dr. Bill McIntosh of the New Mexico Bureau of Mines and Mineral Resources is a volcanologist who specializes in geochronology and paleomagnetism. Bill uses an analytical technique called argon-argon geochronometry to measure the age of certain minerals within volcanic rocks. The technique is very precise; he can usually determine the age of a volcanic rock to within a small fraction of one percent of its true age. By analyzing small crystals within pumice from the San Antonio flood deposits, Bill determined that the pumice formed during an eruption 1.6 million years ago. This is precisely the age of the lower part of the Bandelier Tuff, a soft, porous, pumice-bearing volcanic rock that forms the spectacular canyons and caves in Bandelier National Monument and White Rock Canyon near Los Alamos. Interestingly, remnants of the tuff near the bottom of White Rock Canyon show that the Bandelier eruption filled and dammed an ancient canyon through which the Rio Grande flowed prior to the eruption.

Figure 2—Fine volcanic ash (below) and coarse pumice in flood deposits near San Antonio.

Now that we are certain of the age and source of the pumice, we are left wondering about the age and origin of the subsequent flood that swept the pumice and ash far to the south. As can be seen on television news broadcasts, we understand the dynamics of modern flooding by direct observation: perhaps a hurricane comes ashore causing heavy rainfall and widespread flooding, or a poorly engineered dam fails during an earthquake. But because of the lack of records, the causes of ancient (prehistoric) floods are in most cases difficult to determine. One technique that has provided useful clues about the origin of the flood deposits near San Antonio is paleomagnetic analysis. When volcanic rocks solidify, or when sedimentary rocks are deposited, magnetic minerals in the rocks act as tiny compass needles and lock-in the record of the Earth's magnetic field. Because the location of the Earth's magnetic pole wanders slowly through time, paleomagnetic analysis can reveal if two rocks formed at about the same time (similar

paleomagnetic directions) or at different times (different paleomagnetic directions). By comparing the paleomagnetism of the flood deposits near San Antonio with that of the Bandelier Tuff, Bill McIntosh found no difference in their paleomagnetic directions. This similarity indicates that the flood deposits are not much younger (probably no more than about 500 years) than the 1.6 million-year-old Bandelier eruption from which they were derived.

So we now have a series of clues that can help us with the *how*? and *why*? parts of our investigation:

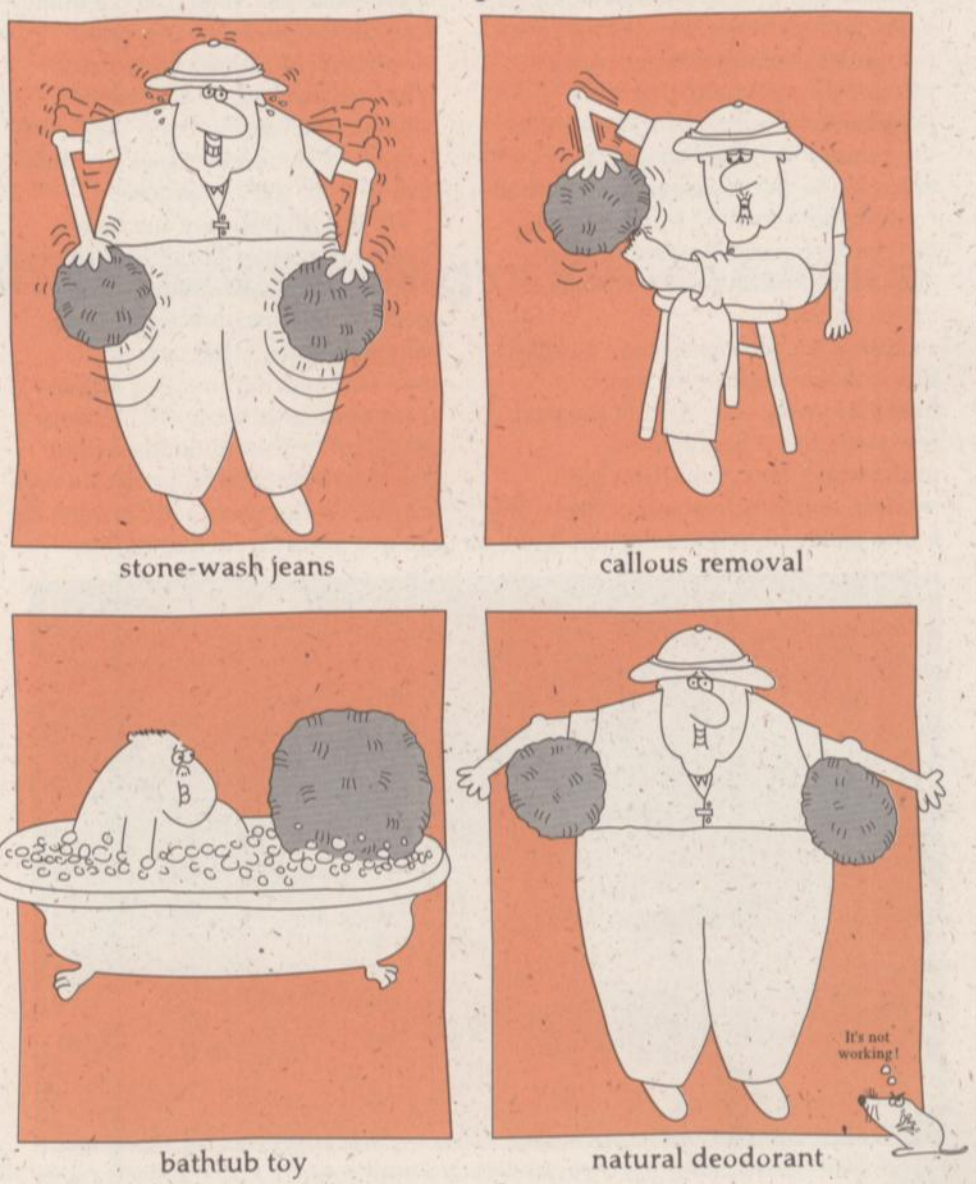
1) The flood deposits near San Antonio are composed of pumice and ash derived from the 1.6 million-year-old Bandelier eruption in the Jemez Mountains.

2) The Bandelier eruption filled and dammed the canyon of the ancient Rio Grande near White Rock, east of Los Alamos.

3) Flood deposition near San Antonio occurred shortly after (geologically speaking) the 1.6 million year volcanic eruption in the Jemez Mountains, as shown by paleomagnetic data.

From these lines of evidence, we can reconstruct the probable geologic history of the flood deposits. About 1.6 million years ago, a great volcanic eruption occurred in the Jemez Mountains. Pumice-bearing volcanic rocks dammed the Rio Grande in a canyon along the east side of the Jemez Mountains, causing a lake to begin to form upstream of the dam. This lake filled with water over a period of years, decades, or even centuries (we don't know exactly, because the paleomagnetic evidence only necessitates the filling took less than about 500 years). Eventually, the lake overtopped and breached the volcanic dam and, as the lake rapidly drained, created a large flood that rolled down the Rio Grande valley at least as far as San Antonio, where the presence of turkey bones and remnants of tree branches in the resulting deposit attest to the destruction as the flood wave crashed through the riverside bosque. Subsequent erosion by the Rio Grande has removed most traces of flood deposits from the valley. The gray bluffs near San Antonio, born of fire and water, provide mute testimony of the power of the natural forces that have shaped our state.

## Uses for pumice



# LEGO™ toys lost at sea

Last winter, almost 5 million LEGO pieces were lost overboard from a freighter that was en route from the Netherlands to New York City. A rogue wave on Feburary 13, 1997 tilted the ship back and forth over a 100 degree arc, freeing 62 enormous shipping containers, one of which held the LEGO pieces.

The spill occurred about 20 miles from Lands End, England. On the beach near Cornwall, England, kids have found some of the seagoing LEGO toys that have washed ashore. Fittingly, most of the toy pieces belong in kits depicting ocean scenarios–scuba divers, flippers, octopuses, life rafts, etc.

Ocean current researchers (Ebbesmeyer, 1997) estimate that beachcombers in America may find some of these LEGO pieces along the coasts of Florida, Georgia, and the Carolinas by summer of 1998. Some of the LEGO pieces may travel northward through the Arctic Ocean, along the Northeast passage and south to Alaska–a journey that could take a dozen years. The currents near Alaska could route the floating toys westward to Japan, then eastward to the beaches of British Columbia, Washington, Oregon, and California. The oceans of the northern hemisphere will probably see an even distribution of the lost LEGO toys by the year 2020.

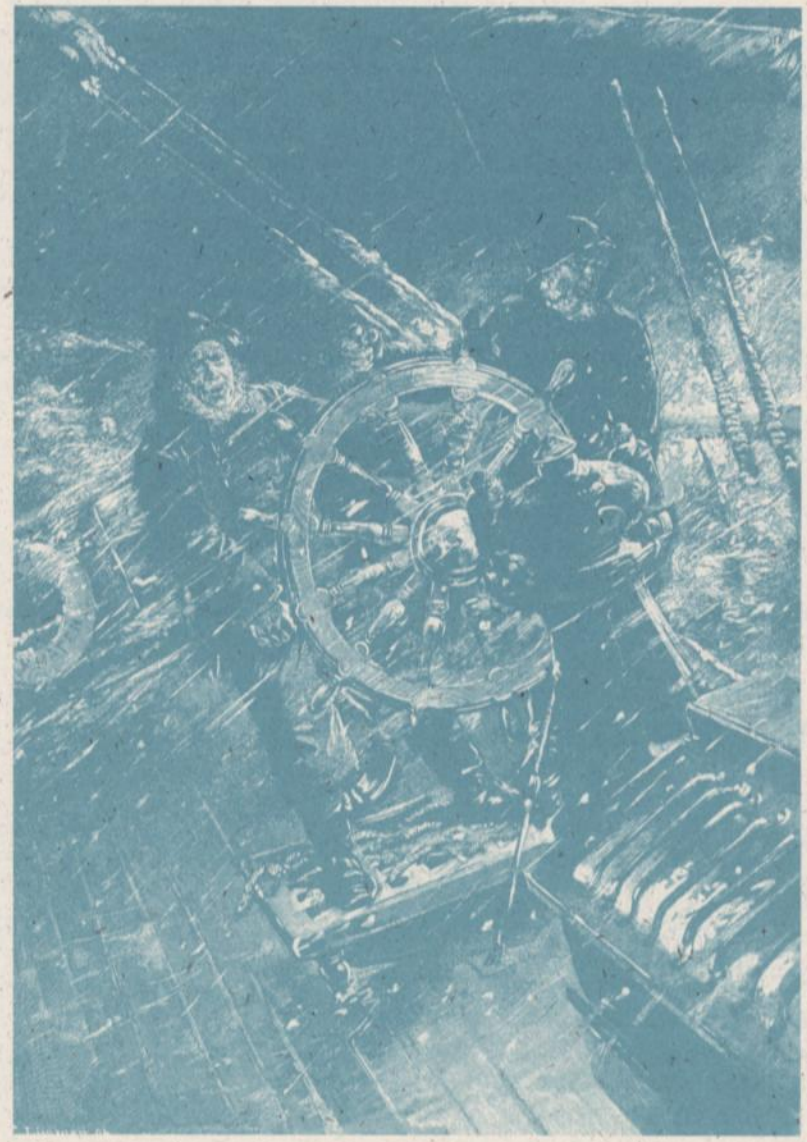
Is 5 million LEGO pieces a lot? Not really, when you consider that as of 1996, the Denmark based LEGO group is reported to have produced 180 billion pieces. . . enough for every person now on the planet to own 30 pieces! It's a good thing that not all of them are adrift!

Note: Beachcombers are encouraged to report finding drifting objects to Dr. Curtis Ebbesmeyer, 6306 21st Ave., Seattle WA, 98115; visit the Beachcomber's Alert web site at http://www.beachcombers.org.

Source

Ebbesmeyer, C.C., 1997, Rogue wave grabs 5 million LEGO toy pieces: Beachcomber's Alert, The Beachcomber's and Oceanographer's Association, Seattle, Washington, vol. 2, no. 2, pp. 5-6.

–story by S. Welch



# New Mexico Tech provides two earthquake information web sites

New Mexico Bureau of Mines & Mineral Resources (NMBM&MR), has recently developed a website about earthquakes; the site address is **http://tremor.nmt.edu**. The Geophysics group at New Mexico Tech, which operates the *New Mexico Tech Seismic Observatory*, also has posted a related website that focuses specifically on recent earthquake activity in New Mexico. The site address is **http://www.ees.nmt.edu/Geop/recentquakes.html.**

The **Tremor** earthquake education site was designed for a non-technical audience and contains an explanation of the Richter scale, a history and epicenter map of past earthquakes in New Mexico, earthquake preparedness instructions, and links to additional earthquake information on the web. The **Recentquakes** site of the New Mexico Tech geophysics group provides press releases on recent seismic activity and educational pages on seismometry, along with links to their extensive list of more technical, open-file reports and seismic data.

During late December 1997 and early January 1998, a swarm of earthquakes were felt in central New Mexico, between Mountainair and Willard. The Willard Swarm earthquakes (maximum magnitude 3.8), while widely felt, were not especially large by New Mexico standards. New Mexico has a long history of earfhquakes including a famous 1906 event in the Socorro area, which was estimated to be greater than magnitude 6.0, a magnitude 5.5 earthquake near Dulce in 1966, and a swarm of 34 earthquakes between magnitude 2.0 and 4.7 in the Bernardo area during 1989. There are records of 1,111 seismic events felt in New Mexico between 1849 and 1975, including three caused by atomic bomb explosions in 1945, 1961, and 1967.

Some earthquakes that have occurred in southeastern New Mexico are thought to be related to oil and gas production; a series of small earthquakes recorded near Heron and El Vado reservoirs in northern New Mexico were caused by the weight of the water in the reservoirs. Most of New Mexico's earthquakes, however, are caused by naturally occurring tectonic forces within the Earth's crust.

Paleoseismic studies, in which geologists dig trenches across known faults to examine displaced strata, have also provided evidence of large prehistoric earthquakes within the boundaries of modern-day New Mexico.

Development of the NMBM&MR **Tremor** earthquake information web site was funded by a grant from the Federal Emergency Management Agency (FEMA), administered through the New Mexico Department of Public Safety, with state matching funds from the NMBM&MR. For additional information, write to William C. Haneberg, NMBM&MR, 2808 Central Avenue SE, Albuquerque NM 87106; or call (505) 262-2774; or e-mail him at haneberg@nmt.edu.

# What's shaking in Willard?

**Tony Lupo**
*Graduate Student*
Dept. of Earth and Environmental Sciences
New Mexico Tech

Since December 23, 1997, approximately 150 earthquakes have been recorded in the region of Willard, Mountainair, and Estancia in central New Mexico. The largest of these events include a magnitude 3.8 recorded on January 4th of this year and a magnitude 3.0 recorded on December 31st, 1997, both of which were widely felt by residents of central New Mexico.

The epicenter, or the point at the earth's surface above the source of these earthquakes, is approximately 10 kilometers northeast of Mountainair. This series of recent seismic events, which began on December 23, 1997, is now called the ``Willard Swarm'' because of its proximity to the community of Willard. The word ``swarm'' is associated with an earthquake sequence in which there is an increase in the number and strength of events, often climaxed by a maximum magnitude event (in this case January 4th) somewhere near the middle of the sequence, after which a decline in the number and strength of the events occurs. Well-recorded smaller events can often be used more effectively than the largest events to geophysically characterize the region of tectonic activity in the earth's crust responsible for the swarm.

This is precisely what Dr. Rick

Aster (coordinator of New Mexico Tech's geophysics program) had in mind when he sent two graduate students to Mountainair to aid C.L. Edwards and his team of geophysicists from Los Alamos National Laboratory (LANL) in the deployment of six temporary seismic stations. The stations were placed in key areas around the epicenter of the Willard Swarm and were maintained for approximately two weeks by geophysics graduate students (Joe Leon and myself) from New Mexico Tech. The data collected from the temporary seismic array should allow geophysicists at New Mexico Tech to better locate the source locations and directions of faulting that occurred in the Willard Swarm, which will enhance our understanding of the regional tectonics responsible for such events. Earthquake seismograms from the Willard Swarm recorded in Albuquerque are available on line at the USGS Albuquerque Seismological Laboratory web page (http://aslwww.cr.usgs.gov/Seismic_Data/nm_quake.html) and are very similar to the data collected from the LANL temporary seismic array. For more information regarding New Mexico earthquakes, we encourage you to check out the New Mexico Tech Geophysics homepage at (http://www.ees.nmt.edu/Geop).

## Largest Historical Earthquakes in New Mexico (through January, 1998)

| Date | Magnitude | Nearest City |
|---|---|---|
| 1869, April | 5.2 | Socorro |
| 1893, Sept. 7 | 5.2 | Belen |
| 1895, Oct. 31 | 4.5 | Socorro |
| 1897, — | 4.5 | Socorro |
| 1904, Jan 20 | 4.5 | Socorro |
| 1906, July 2 | 4.5 | Socorro |
| 1906, July 12 | 5.5 | Socorro |
| 1906, July 16 | 5.8 | Socorro |
| 1906, Nov. 15 | 5.8 | Socorro |
| 1906, Dec. 19 | 4.5 | Socorro |
| 1918, May 28 | 5.5 | Cerrillos |
| 1931, Feb. 5 | 4.5 | Albuquerque |
| 1935, Feb. 5 | 4.5 | Albuquerque |
| 1935, Feb. 21 | 4.5 | Bernardo |
| 1935, Dec. 22 | 4.5 | Belen |
| 1938, Sept. 17 | 4.5 | Glenwood |
| 1938, Nov. 2 | 4.5 | Glenwood |
| 1939, Jan. 20 | 4.5 | Glenwood |
| 1939, Jun. 4 | 4.5 | Glenwood |
| 1947, Nov. 6 | 4.5 | Albuquerque |
| 1949, May 23 | 4.5 | Vaughn |
| 1955, Aug. 3 | 4.5 | Dulce |
| 1960, Jul. 23 | 4.5 | Bernardo |
| 1961, Jul. 3 | 4.5 | Socorro |
| 1966, Jan. 23 | 4.8 | Dulce |
| 1976, Jan. 5 | 4.7 | Gallup |
| 1989, Nov. 29 | 4.7 | Bernardo |
| 1990, Jan. 29 | 4.6 | Bernardo |
| 1992, Jan. 2 | 5.0 | Eunice |

Listed above are the largest earthquakes in New Mexico for the period of 1869 through 1998. Magnitudes for earthquakes prior to 1962 are calculated from maximum reported seismic intensities (Modified Mercalli) using an empirical formula derived for New Mexico shocks. Magnitudes based on earthquake intensity have an uncertainty of $\pm 1/2$ magnitude unit. Magnitudes from 1962 to the present are determined from an instrumental duration magnitude scale developed for earthquakes in or near New Mexico. Magnitudes based on instrumental recordings (seismograms) have an uncertainty of $\pm 1/4$ magnitude unit.

Prepared by Kuo-wan Lin and Allan Sanford from data in U.S. Geological Survey publications and in Open-File Reports and on file at New Mexico Tech. More complete information on these earthquakes is available on-line at: http://www.ees.nmt.edu/Geop/Museum_Posters/Nmseismology.html.

# INERAL MUSEUM

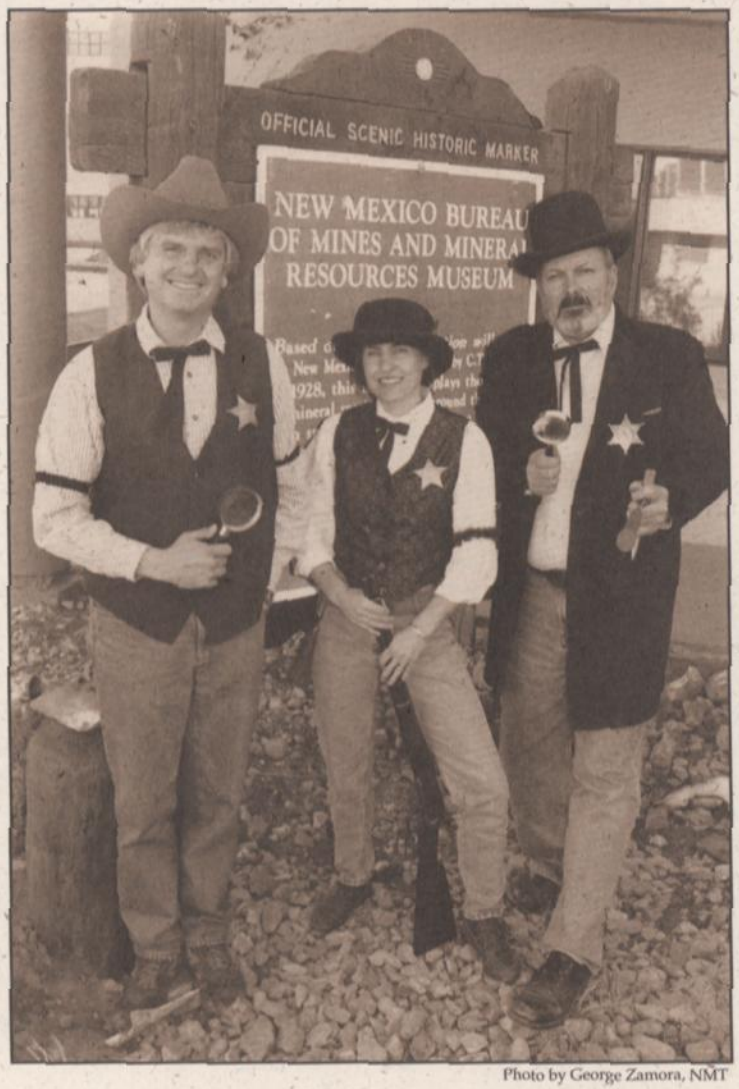



Photo by George Zamora, NMT

## THE MINERAL POSSE

Staff: Dr. Virgil Lueth, *Mineralolgist and Curator*, Lynn Heizler, *Assistant Curator*, Robert Eveleth, *Sr. Mining Engineer/Associate Curator*

## ONTACT INFORMATION:

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w Mexico Bureau of Mines and
lineral Resources
w Mexico Tech
Leroy, Socorro, NM 87801
5) 835-5154
nail: vwlueth@nmt.edu
osite: http://geoinfo.nmt.edu

## MUSEUM HOURS

Monday through Friday from 8:00 a.m. to 5:00 p.m. (closed for lunch)
Saturday and Sunday from 10:00 a.m. to 3:00 p.m.
*Closed official Institute holidays*

Back in the old days, a wanted poster was sometimes improved by the daring addition of a mustache. For our more adventurous readers, we have provided a selection of mustaches to cut and paste onto our wanted poster—just don't let the sheriff catch you!

# New Mexico's Most WANTED MINERALS

## BARITE

**DESCRIPTION:** Watch for Barite to appear as a colorless to white, yellow, red, blue, brown, or black mineral. Its *luster* varies from vitreous (like glass) to pearly. It has *cleavage* in two directions and a *hardness* ranging from 2.5 to 3.5. Barite's most diagnostic feature is its high *specific gravity*, which ranges from 4.3 to 4.7. Chemical name: Barium sulphate. Formula: $BaSO_4$

**WANTED FOR:** Because of Barite's high density, it is in demand for adding to well-drilling fluids. Barite also is used in paper and rubber as a filler, in paint as an extender, and in barium drinks for medical X-rays.

**HIDEOUT:** Barite can be found in low temperature hydrothermal veins and limestone replacement deposits. Barite is known to associate with Fluorite (as seen in the picture above).

**LAST SEEN AT LARGE:** In New Mexico, be on the lookout for Barite, which is known to occur in the following Mining Districts (see locality map for major occurrences):

Tijeras District–Bernalillo County
Bishop Cap, Tonuco, and Rincon Districts–Dona Ana County
Caballo Mountains and Derry Districts–Sierra County
Hansonburg and Chupadero Mesa Districts–Socorro County


**ALIASES:** Heavy spar; bar spar; tiff (in Missouri).

Specimens of Barite have been apprehended and are on display at the Mineral Museum at New Mexico Bureau of Mines and Mineral Resources, located on the campus of New Mexico Tech in the Gold Building, Room 200.

*July 14–16, 1998*

**Rockin' Around New Mexico 1998**

Teachers! Don't miss this exciting opportunity to attend an annual summer workshop which will be hosted in 1998 by Chino Mines, a Division of Phelps Dodge, located near Silver City. Co-sponsors include BHP Minerals, New Mexico Bureau of Mines and Mineral Resources, New Mexico Geological Society, and others. This year, teachers will have a chance to learn about mining, the role of minerals in society, mineralogy, and other geologic topics. Field trips will include a tour of the copper mine, panning for gold, rockhounding, etc. Plenty of curriculum materials will be provided. The workshop is free to educators; (participants pay for their own travel and lodging). There is a one-hour graduate credit available through the Master of Science Teaching program at New Mexico Tech. Space is limited, so please contact Susie Welch for registration information ASAP:

**Rockin Around New Mexico**
New Mexico Bureau of Mines and Mineral Resources
New Mexico Tech, 801 Leroy, Socorro, NM 87801
phone: (505) 825–5112;
fax: (505) 835–6333
e-mail: susie@nmt.edu

*Aug. 7–9, 1998*

**Summer Field Conference/ Southwest Section of the National Association of Geoscience Teachers (NAGT)**

Western New Mexico University (WNMU) in Silver City, NM will host the NAGT Summer Field Conference this summer. Earth Science Teachers can attend workshops and receive Professional academic credit through WNMU if interested. There will be a nominal fee ($10–20) to cover materials.

Workshop topics will include *Cameras in the classroom; Internet;* and *Innovative and Effective Teaching Techniques*. There will be a field trip to Chino Mines, and field geology activities for children (families are welcome!). A special collecting field trip for fossils and minerals in the Silver City area will be led by the Rolling Stones Gem and Mineral Club on Sunday. For registration information, contact:

Mary E. Dowse
Department of Natural Sciences
Western New Mexico University
Silver City, NM 88062
phone: (505) 538–6352
e-mail: dowsem@silver.wnmu.edu

*June 17–20, 1998*

**7th Annual National Minerals Education Conference**

**Pittsburgh, PA**

This conference is being hosted by the Pittsburgh Section of the Society for Mining, Metallurgy, and Exploration, and offers networking opportunities for professionals from education, government and industry regarding mining and the role of minerals in society. Mineral Education curricula , tools, projects and programs will be showcased. Field trips to local mines, manufacturers, and museums will be offered.

## Sources for Earth Science Information

A free teacher's packet including a poster, lesson plans, activities, and a list of mineral resource information can be obtained by calling or writing to:

**Mineral Information Institute**
**Jackie Evanger**
**475 17th Street; Suite 510**
**Denver, CO 80202**
**(303) 297–3226**

Information on Earth Science programs, projects, reports, products and their sources is available from:

**US Geological Survey**
**Earth Science Information Center**
**(USGS ESIC)**
**Call 1–(800) USA–MAPS**

or in New Mexico, contact:

**Amy Budge**
**Earth Science Information Center**
**Earth Data Analysis Center**
**University of New Mexico**
**Albuquerque, NM 87131**
**(505) 277–3622**

Information on earthquakes in New Mexico is available by contacting:

**Program Manager**
**New Mexico Earthquake Preparedness Program**
**Department of Public Safety**
**P.O. Box 1628**
**Santa Fe, NM 87504**
**(505) 476–9617**

***Subscriptions:***

*Lite Geology* began as a small Earth-science publication designed and scaled for New Mexico. Our subscription list now includes a large number of out-of-state readers. In order to keep up with the demand for this publication from outside of New Mexico, we now charge **$4.00 per year for out-of-state readers,** which covers the cost of mailing. If you are a paid subscriber, you will find a number after your name on the mailing label. This number represents the last *Lite Geology* issue in your subscription. When the issue number is the same as that on your mailing label, it's time to renew your subscription. If you have questions, please call Debbie Goering at (505) 835–5490.

### Lite Geology

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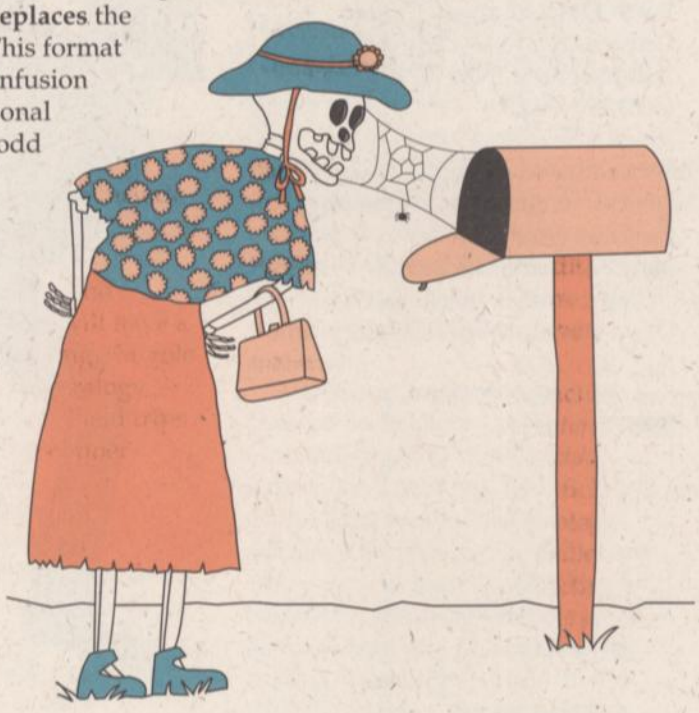
**Out-of-state subscribers are charged $4.00 per 4 issues to cover mailing costs

# Attention All Subscribers!

We explained in an earlier issue that funding cutbacks have slowed our printing schedule. Because of this problem, we have changed our system for identifying each issue in print. We have dropped the old system of Spring/Summer/Fall/Winter and have switched to a simple, numbered series. This current issue is **Number 19** (which **replaces** the Spring 1997 issue). This format should help avoid confusion that arises when seasonal issues are printed at odd times of the year.



In the future, please refer to the issue number on the front page. We hope that this new system will be easier to track. If you have any questions about your subscription status, please contact Debbie Goering at (505) 835–5490. —ed.

*Lite Geology* is published by New Mexico Bureau of Mines and Mineral Resources (Dr. Charles E. Chapin, *Director and State Geologist*), a division of New Mexico Tech (Dr. Daniel H. Lopez, *President*).



**Purpose:** to build Earth Science awareness by presenting educators and the public with contemporary geologic topics, issues, and events. Use Lite Geology as a source for ideas in the classroom or for public education. Reproduction is encouraged with proper recognition of the source. *All rights reserved on copyrighted © material reprinted with permission within this issue.*

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