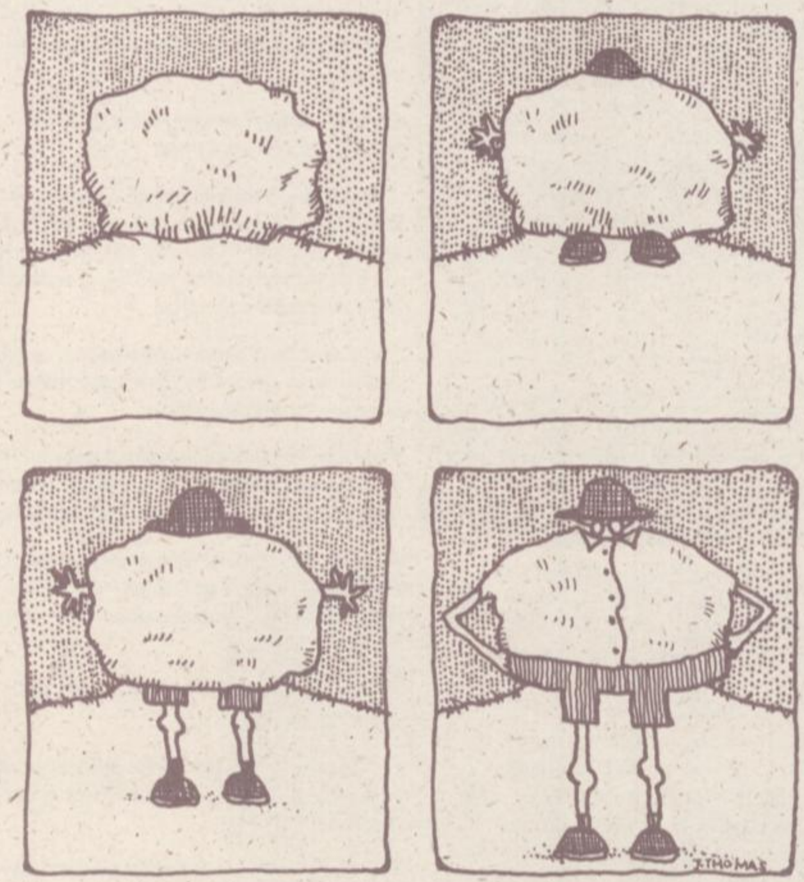
Fall 1992

LITE geology

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

New Mexico Bureau
of
Mines and Mineral
Resources
(NMBM&MR)



evolution of a geologist

This Issue:

Earth Briefs

Rising Levels of Mercury in Fish

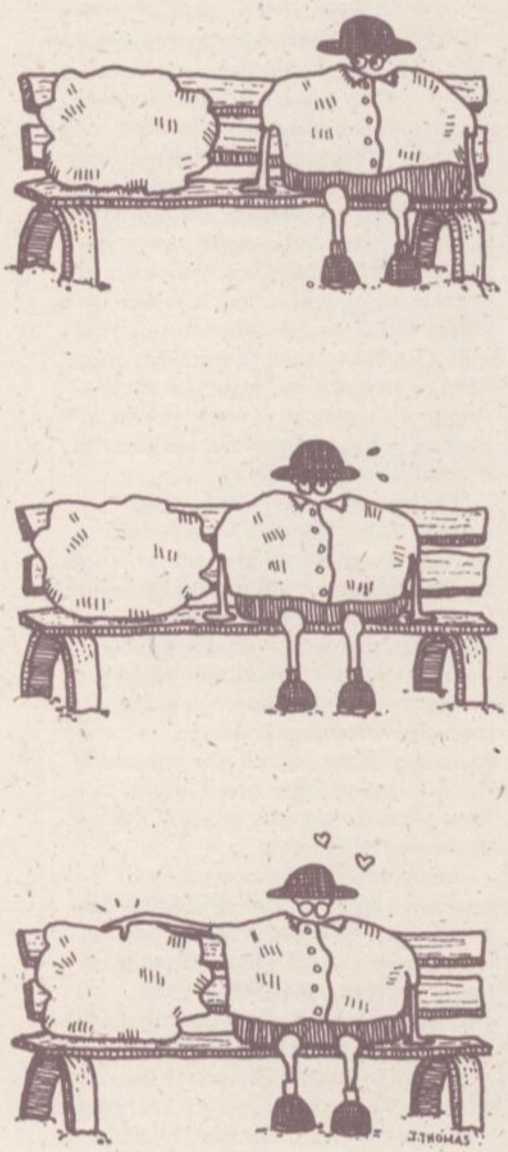
Lynn Brandvold
Senior Chemist, NMBM&MR

Mercury levels in fish in New Mexico's lakes and reservoirs have been rising over the last 20 years, while the level of mercury in the water has remained about the same. This seemingly contradictory statement is correct because mercury has the ability to concentrate as it moves up the food chain. Microorganisms in the water methylate mercury (convert it to an organic form), which then is picked up by plants and is also absorbed through fish gills. Organisms tend to store this organic form of mercury; as bigger fish eat the smaller fish, mercury levels increase in the bigger fish. Larger fish are likely to contain the most mercury.

The source of this mercury is not known. Many possible sources exist: stack gases from coal-fired power plants, smelter emissions, old mining and milling wastes, sediment carried from mineralized areas by run-off into the rivers, mercury vapor lamps, oil-gas pressure-sensing equipment, industrial or municipal discharges, or even mercurochrome poured into household drains. This problem is not unique to New Mexico. Mercury levels in fish are increasing nationwide.

Analyzing fish for mercury is an expensive and time-consuming job. Last summer the New Mexico Environment Department (NMED) had a backlog of fish to analyze. The NMBM&MR chemistry laboratory had just purchased a new mercury analyzer, and volunteered assistance in analyzing some of these fish. About 200 samples have been analyzed at the Bureau to date. The Bureau chemists also were interested in whether the fish lost the mercury when cooked. A set of experiments was devised in which the fish were either fried, cooked in a microwave oven, or baked and then analyzed for mercury. Unfortunately they found that the mercury was not lost by cooking.

The NMBM&MR chemistry laboratory is also analyzing for mercury in river and stream sediments, as well as in rock and mineral samples gathered from around New Mexico, in order to better understand the background levels of mercury. They hope to ultimately put together a geochemical map of mercury levels around the state.



a geologist
dates a rock

Troublesome Rock Falls Along the Rio Grande Gorge

William C. Haneberg
Engineering Geologist, NMBM&MR

The geologic processes of **tectonic uplift**, **weathering**, **erosion**, and **deposition** combine to continually redistribute soil and rock and reshape the landscape. Some processes, for example **soil creep** and **glacial movement**, are slow and occur over tens, hundreds, or even thousands of years. Other processes, for example **rockfalls** and **earthquakes**, are rapid and can occur in a matter of seconds or minutes. In many cases, these rapid processes occur with little or no warning. The analysis and prediction of geologic processes that may adversely affect human lives and property is known as geologic-hazard assessment. During recent years, parts of New Mexico Highway 68 between Embudo and Pilar, which runs through the southern portion of the Rio Grande Gorge, has been subjected to two catastrophic rockfalls. In September, 1989, five people were killed and 14 injured when a large **basalt** boulder, loosened during a rainstorm, tumbled downhill, and struck a bus.

On the night of July 25, 1991, again during a heavy rainstorm, many **debris flows** and rockfalls cascaded onto the highway, and the road was closed for 19 hours. The most spectacular event to occur that night was the fall of a large **schist** boulder, which left a 14x5x5 meter (45x15x15 foot) crater in the highway before coming to rest on the opposite side of the Rio Grande.

Many smaller rockfalls have tumbled onto the roadway since the highway was built. The New Mexico State Highway and Transportation Department has installed rockfall-protection nets uphill from the roadway just north of Embudo.

Geologists from the New Mexico Bureau of Mines and Mineral Resources visited the July 1991 rockfall site in September 1991. They estimated that the boulder was traveling at about 21 meters per second (47 miles per hour) and struck the road with 85,000,000 Newton meters(32,000 foot tons) of **kinetic energy**, which is several hundred times greater than the capacity of the protective nets installed to stop smaller rockfalls along the gorge. To put this figure into perspective, 85,000,000 Newton meters is equivalent to about 24 kilowatt hours of electricity, or enough to supply an average household for two to three days!

Glossary of Geologic-Hazard Terms

Basalt-*A dark-colored rock containing iron and magnesium and formed from molten material.*

Debris Flow-*A moving mass of rock fragments, soil, and mud.*

Deposition-*The constructive process of accumulation by which materials are laid, placed, or thrown down by natural agents such as the mechanical settling of sediments from suspension in water.*

Earthquake-*A sudden motion or trembling in the Earth caused by the abrupt release of slowly accumulated strain.*

Erosion-*The process by which soil and rock are loosened, dissolved, or worn away and transported by an agent such as weathering.*

Glacial Movement-*The process by which a large mass of ice creeps slowly downslope, or outward in all directions, due to the stress of its own weight.*

Kinetic Energy- *Part of the energy of an object in motion.*

Rockfall-*The relatively free falling and/or tumbling of a newly detached piece of bedrock down a slope.*

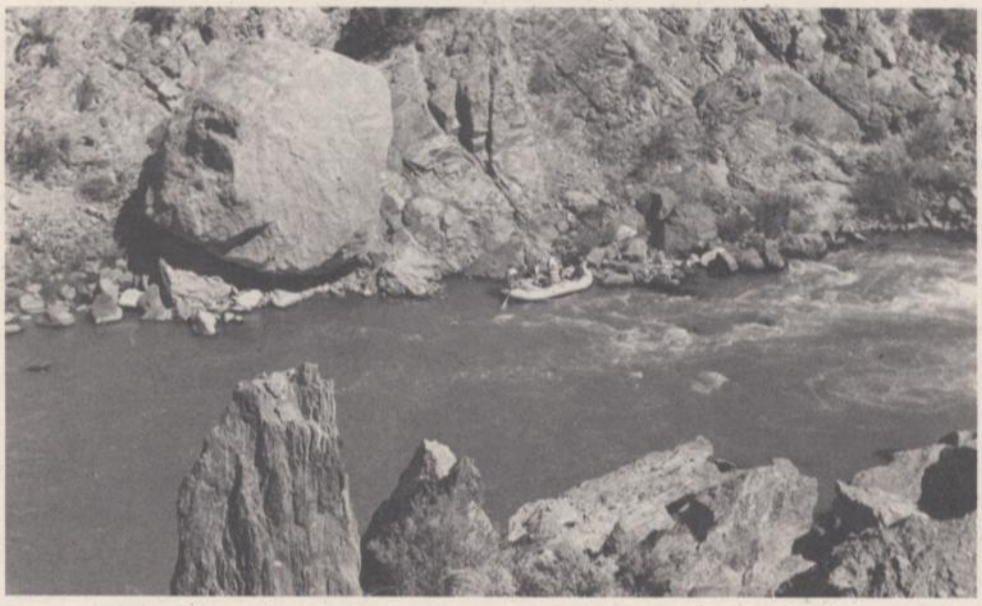
Schist-*A type of rock with a planar, layered crystalline structure, that has been formed under high temperatures and pressures.*

Soil Creep-*The gradual, steady downhill movement of soil and loose rock material on a slope.*

Tectonic Uplift-*An upward movement of part of the Earth's crust, generally occurring over broad areas, due to stresses within the earth.*

Weathering-*The destructive process by which rock is exposed to atmospheric agents and is changed in appearance and form.*

Reference-*Bates, R. L., and Jackson, J. A., (editors), 1980, Glossary of geology: American Geological Institute, Alexandria, VA, 2nd edition, 749 pp.*



The upper photograph illustrates the swath of destruction created by the July 1991 boulder as it slid and rolled down the southeastern side of the gorge, after which it struck the highway and came to rest across the river. The boulder, in its final resting position along the northwestern bank of the Rio Grande, is shown in the lower photograph (note rafters for scale). Photos by Paul Bauer, NMBM&MR.

C.T.Brown, "the New Mexico School of Mines' Best Friend and Benefactor"

Robert W. Eveleth
Senior Mining Engineer, NMBM&MR

C. T. Brown was an early benefactor of the New Mexico School of Mines (now popularly known as New Mexico Tech), and his influence on the school, dating back to the turn of the twentieth century, still lingers. Brown is best remembered for his unfailing devotion to, and support of, the New Mexico School of Mines. A brief note in the *Gold Pan* (1925), states "It was largely due to his efforts that the school was started and maintained."

In recognition of C.T. Brown's many contributions to the school, the administration building was named Brown Hall after being rebuilt in 1928 following a fire. Across campus, at the Bureau of Mines and Mineral Resources, the tradition and memory of this man are preserved with reverence and care. In the Mineral Museum of the Bureau, much of Brown's mineral collection, along with a few extant objects and artifacts associated with his life and career, are displayed.

As early as 1899, Cony T. Brown began offering a special prize, a gold medal, to that student at the NM School of Mines who displayed particular proficiency in assaying, metallurgy, etc. The recipient of the first gold medal, in 1900, was Carl J. Homme. The Brown Medal became a tradition and C.T. Brown personally awarded the medal through 1924, at the last commencement he attended before his death in January 1925. The Brown Medal is still awarded today.

He was born Cony Thomas Brown in Corrina, Maine, on November 30, 1856. He left school at the age of 16 to apprentice as a tinsmith. Three years of that was apparently enough for young Brown, and he hopped a train to far-off Ellis, Kansas, arriving on the brand-new rails of the Union Pacific (Biography, 1895).

After four years in Ellis, he became acquainted with a group of men who owned mining property in New Mexico. These men must have recognized Brown's great enthusiasm, honesty, and attention to detail (traits that would become lifelong trademarks), because they hired him, barely into his 20s, to become superintendent of operations for Ellis Mining Company in the Water Canyon district west of Socorro, New Mexico (Twitchell, 1917; *Bullion*, 1883). When this serendipitous opportunity for a career in mining appeared, he focused all his efforts on self-training and education. By the turn of the century any mention of Brown was usually preceded by the tag line "well-known mining expert" (Western Mining World, 1902).

While mining remained the core of Brown's business interests, he was involved in many other ventures including coal, bicycles, buggies, livery service, and mail delivery (*The Socorro Chieftain*, 1895; Biography, 1895). He was president and manager of the Socorro Light and Power company, president of the Socorro State Bank (Twitchell, 1917), and owner and operator of the renovated Graphic Smelter of Socorro. During his final years, he served as a New Mexico state senator (*The Socorro Chieftain*, 1925; Regents, 1925).

His greatest achievement, from a personal standpoint, must have occurred at commencement in 1914 when the New Mexico School of Mines recognized his many years of effort on behalf of the Institute and the mining industry by awarding him the first honorary degree in the school's history—that of Mining Engineer (Catalog 1937–38).

During his 45-year mining career, Brown assembled a remarkable mineral collection. The collection of about 1500 pieces (Museum Archives) was purchased from the Brown family in 1938 (Catalog, 1945–47). Some of the highlights of the collection today include a very large green smithsonite, a brassy-yellow cadmian smithsonite, several spectacular azurites and native coppers, and a snowy-white "jackstraw" cerrussite—all from the Magdalena district. These and many others are carefully preserved in the Mineral Museum at the New Mexico Bureau of Mines and Mineral Resources in Socorro.

After his death, *The Socorro Chieftain* (1925) recorded that C. T. Brown left this earth with "the richest heritage possible—the memory of one who died in debt to no man, either politically, financially, or morally." It is thus fitting and proper that the Brown collection receive the best care possible, for he was, after all, "the School of Mines' best friend and benefactor" (Catalog, 1933–34).

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Bullion, 1883, issue for July 1, 1883: Newspaper, Socorro, New Mexico, 1883–1888; El Paso, Texas, 1888–1894.

Catalog, 1933–34: New Mexico School of Mines, Socorro, New Mexico.

———, 1937–38: New Mexico School of Mines, Socorro, New Mexico, p. 87.

———, 1945–47: New Mexico School of Mines, Socorro, New Mexico, p. 32.

Gold Pan, issue for February 1, 1925: New Mexico School of Mines, Socorro, New Mexico.

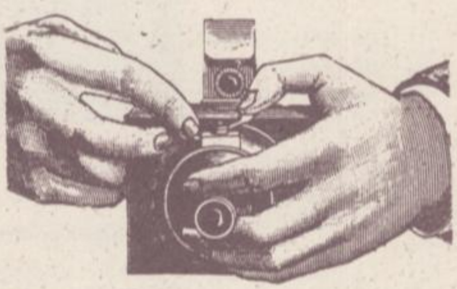
Museum Archives, Catalog of mineral cabinet [of] C. T. Brown, complete annotated descriptions of specimens in Brown collection at time of purchase: Archives of the Mineral Museum, New Mexico Bureau of Mines and Mineral Resources, Socorro, New Mexico.

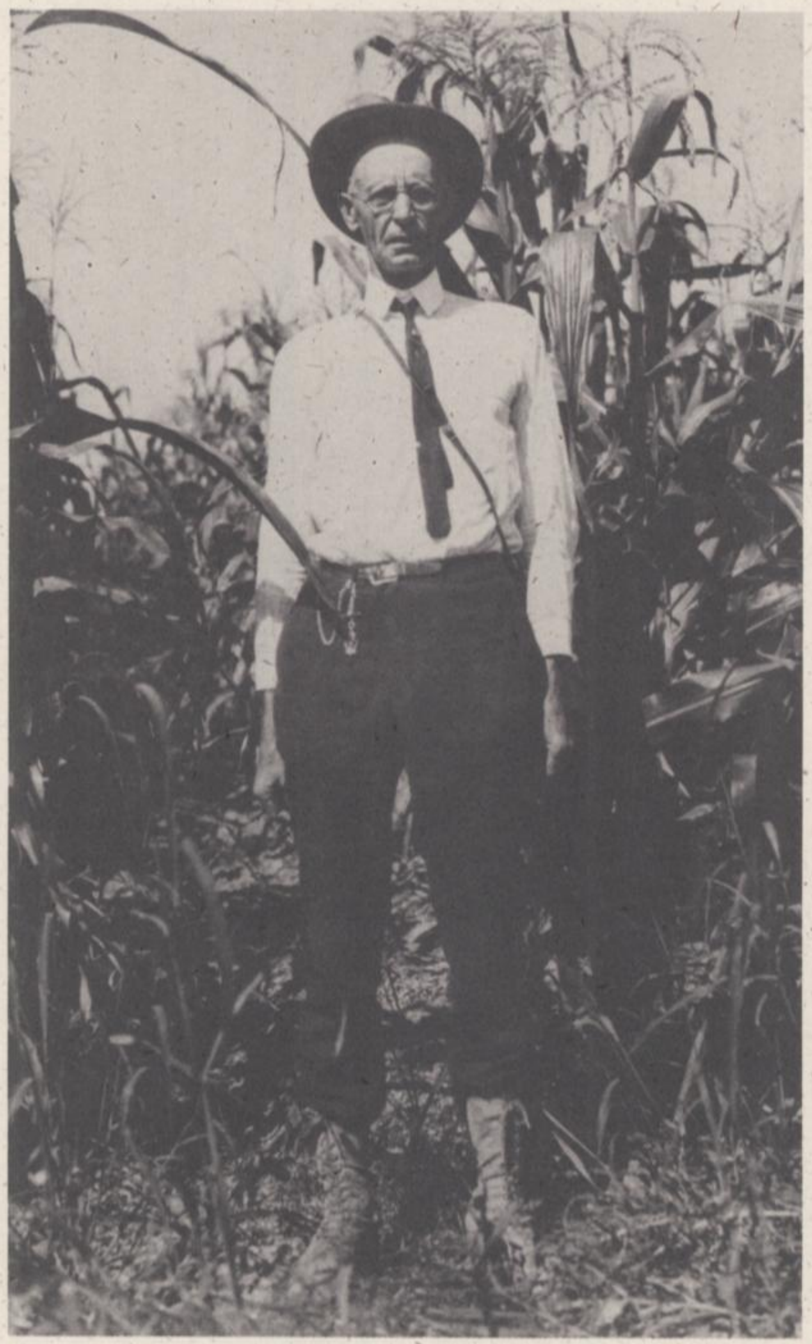
Regents, 1925, Unpublished minutes of the Board of Regents (nee Trustees) of the New Mexico School of Mines, Socorro, New Mexico, p. 113.

The Socorro Chieftain, 1895, issue for August 9, 1895.

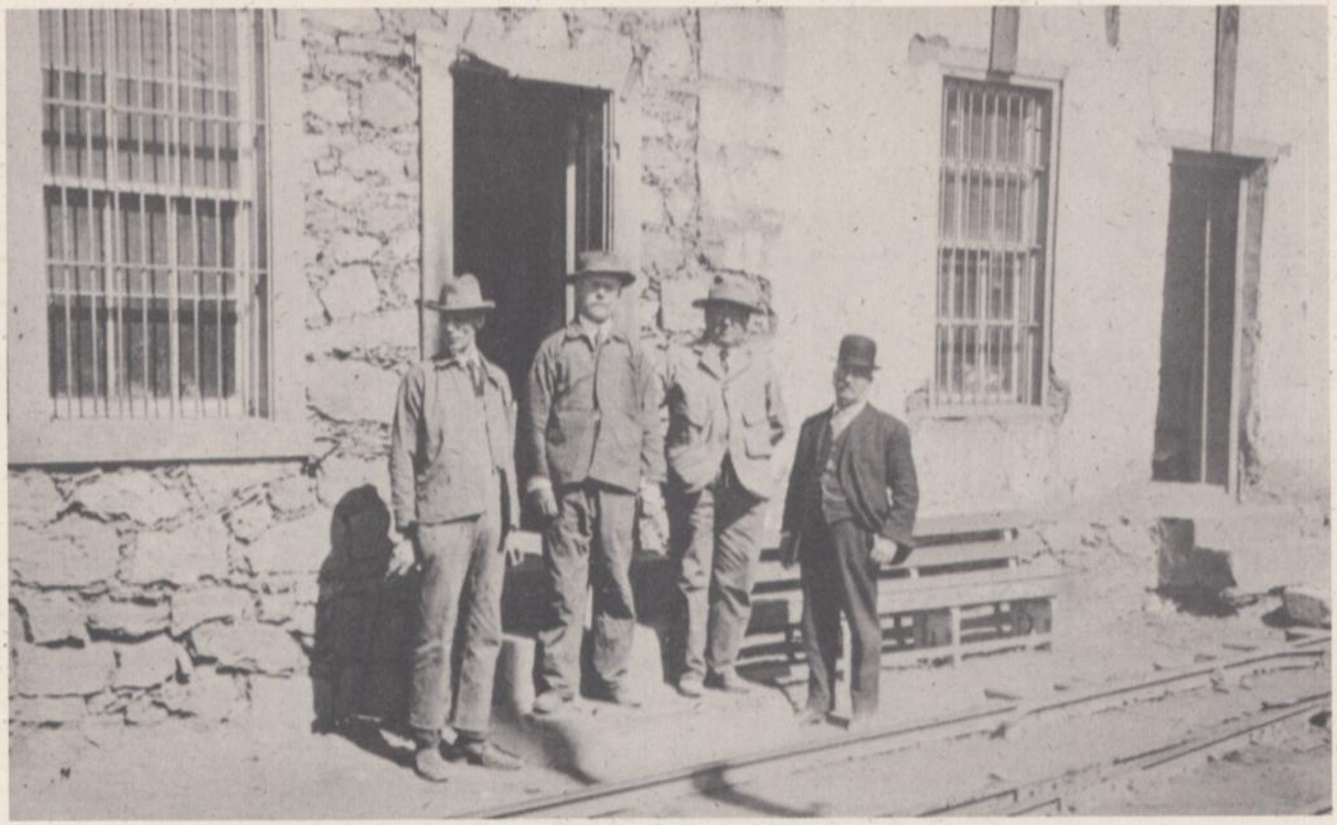
Twitchell, R. E. (editor), 1917, Cony T. Brown; *in* The leading facts of New Mexico history, vol. IV: The Torch Press, Cedar Rapids, Iowa.

Western Mining World, 1902, vol. 17, p. 2.





In the summer of 1922, Brown showed off his unusual height (6'3" or 6'4") against his fine stand of corn in the famous "Cornfield Portrait" (NMBM&MR photo collection #1504).



Brown was southwestern representative for the Empire Zinc Company from 1903 until his death. This view of Brown (on the left) is thought to have been made at the Ozark Mill in the town of Kelly (ca. 1910, NMBM&MR photo collection #1513).

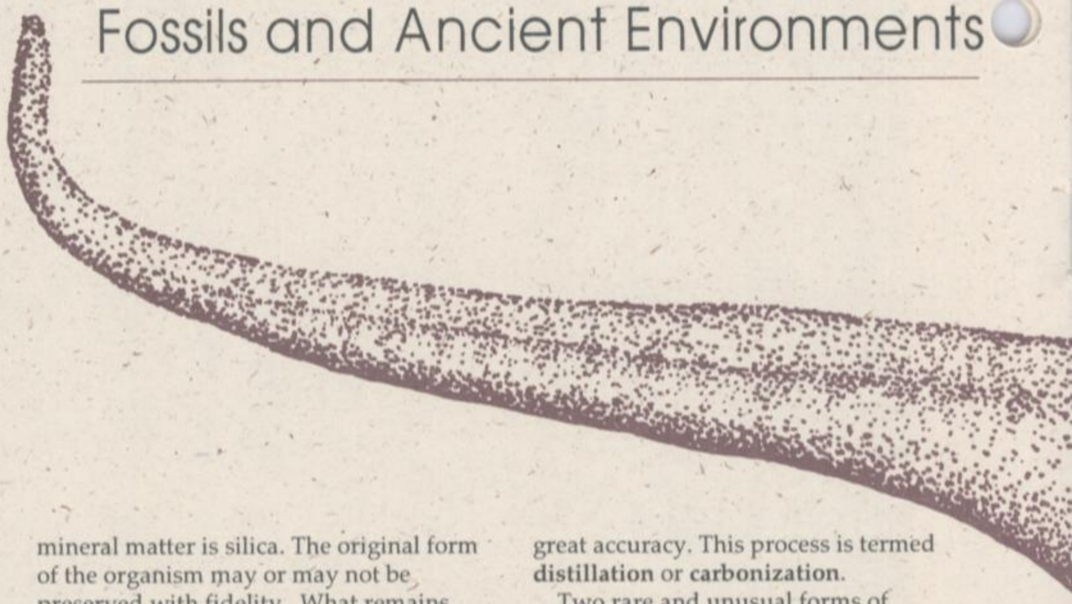
Brown's great discovery at Kelly mine, southwest of Socorro, was that massive amounts of dry-bone ore (valuable smithsonite) were masquerading as limestone. This led to major investment and development in the area as depicted in this photo, where a large, double-drum hoist is being delivered to the future Taylor Shaft site at Kelly (ca. 1907, NMBM&MR photo collection #1505).

C.T. Brown had extensive mining interests in the Water Canyon district and would occasionally move the entire family there to escape the summer heat. In this summer of 1897 view, Brown (with his arm extended) is shown with part of his family. His wife, Anna K. Brown is at the right, and his son Tom is seated at the left. Others are unidentified (NMBM&MR photo collection #1515).

Delivering steam boilers, hoist engines, and other heavy machinery to the Buckeye Mine in Water Canyon in early spring 1899 was a moment in history that Brown felt worth preserving on the photographic plate. Brown is the tall man seated on the second wagon (NMBM&MR photo collection #1647).

Acknowledgments: *The "Cornfield Portrait" provided by Frank and Peggy Dailey was misplaced in the NMBM&MR Mineral Museum archives for many years, until Brown's granddaughter, Mary Louise (Brown) Dillard, requested to see it. The author located the photo, which is now back on display at the Bureau. All other photos were donated to the NMBM&MR photo collection by Mary Louise (Brown) Dillard. The author is indebted to Mrs. Alvin J. (Betty) Thompson and Mr. Cyril Perusek, NMSM Class of '43, for their reminiscences regarding Brown and the Brown mineral collection. This article is an exerpt of a manuscript titled "Many shades of Brown" by the same author.*

Paleontology: Fossils and Ancient Environments



Donald Wolberg
Paleontologist, NMBM&MR

Paleontology is the science concerned with ancient organisms: plants, animals and creatures not-quite-either, that are preserved in the rocks and sediments of the Earth as fossils. Fossils may consist of *actual remains of whole, complete organisms* such as microorganisms preserved in chert or amber; leaves preserved in mudstones or amber; or mammoths frozen in ice. Fossils also may consist of *parts of organisms* such as bones, teeth, shells, or wood altered to varying degrees. If the original materials comprising the organism have weathered away, a fossil may be an actual *impression of the organism* preserved as a cast or mold. Fossils may consist of traces or *remains of an organism's activity* such as tracks or burrows, and even coprolites (fossilized feces).

Exactly how old an organism has to be in order to be termed a fossil is rather arbitrary; for most purposes, a fossil should have a respectable age associated with it. In general, we place the "fossil-nonfossil" boundary at the end of the last Ice Age (Pleistocene Epoch), and the beginning of the Holocene (Recent Epoch), about 12,000 years ago. An organism doesn't have to represent an extinct species in order to be termed a fossil, nor does it have to be heavily mineralized.

The popular notion of fossils as remains of organisms, that is organisms "turned to stone", is not accurate. In fact, the process is actually **replacement**, where original mineral matter is dissolved and replaced by other mineral matter. Most frequently the secondary mineral matter is silica. The original form of the organism may or may not be preserved with fidelity. What remains can be an actual replica of the original organism. Perhaps the most common example of replacement is petrified wood, where the original woody structure and the minerals that originally produced the fossilization of the wood, have been replaced by several forms of silica, various carbonate minerals, and even pyrite.

Most frequently, fossils consist of original material such as shell, bones or teeth to which mineral matter has been added. A variety of minerals may be deposited in any available pore space. The resulting "fossil" is denser than the original. This fossilization process is known as **permineralization.**

Frequently when an organism such as a brachiopod or mollusk shell is entombed in sediment, the original shelly material is dissolved and fine-grained sediments or mineral matter occupy the original space. The cavity that the material occupies is a **mold**, and the replica of the original organism is a **cast**. The quality of the replica can vary greatly, and can range from an accurate representation of the original organism's form to something hardly recognizable.

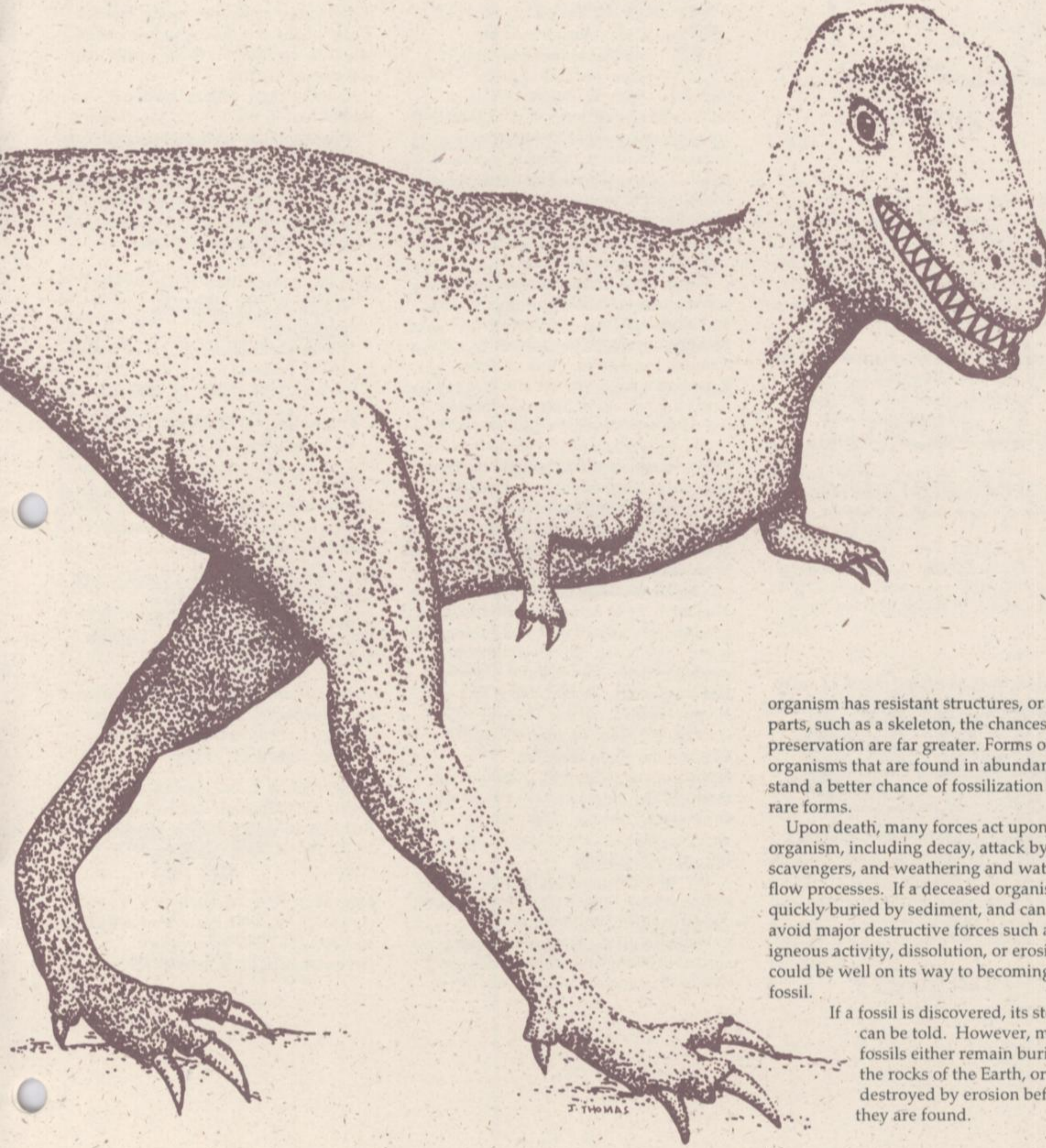
In reducing environments, those that are depleted in oxygen and are possibly rich in organic matter, ordinary decay processes do not take place. Instead, volatile organic compounds are driven off during compaction. Carbon remains behind as a thin film, frequently reproducing the form of the organism with great accuracy. This process is termed **distillation** or **carbonization**.

Two rare and unusual forms of fossilization, **freezing** and **mummification**, can yield the most spectacular fossil remains. A familiar example is the mammoths that, during the last Ice Age, mired in ponds or bogs that froze. The mammoths were entombed in ice deposits for 20,000 or more years. The natural deep freeze of arctic permafrost protected the carcasses to an amazing extent. Skin, hair, blood and stomach contents preserved by freezing have provided a wealth of information about these animals and the environments in which they lived.

Mummification is preservation by desiccation. Fossils preserved by this process include dinosaurs that died about 75 million years ago, and ground sloths that died in southwestern caves some 15,000 years ago. Mummification frequently preserves in great detail the remains of organisms including muscles, internal organs and skin.

Fossilization also may occur when an organism becomes **engulfed** within a preserving medium. Familiar examples include preservation in asphalt, such as that found in the La Brea Tar Pits of southern California. Another example is preservation in amber, a natural resin secreted by trees. Amber has many properties similar to plastics; it has preserved bacteria, leaves, insects, frogs and even lizards. Fossils preserved in amber may be complete and intact.

Certain factors increase the opportunity for an organism to become a fossil. If the



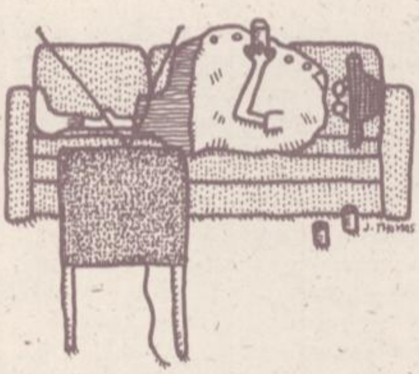
organism has resistant structures, or hard parts, such as a skeleton, the chances for preservation are far greater. Forms of organisms that are found in abundance stand a better chance of fossilization than rare forms.

Upon death, many forces act upon an organism, including decay, attack by scavengers, and weathering and water-flow processes. If a deceased organism is quickly buried by sediment, and can avoid major destructive forces such as igneous activity, dissolution, or erosion, it could be well on its way to becoming a fossil.

If a fossil is discovered, its story can be told. However, most fossils either remain buried in the rocks of the Earth, or are destroyed by erosion before they are found.

igneous

metamorphic



sedentary

Radon: A Potential Problem in Your Home

Virginia T. McLemore
Geologist, NMBM&MR

A silent visitor may be entering homes and schools across the United States. This visitor is tasteless, odorless, and invisible, and only can be detected by scientific instruments. It comes from a naturally occurring radioactive gas called radon. Radon is formed by the decay or breakdown of uranium, which occurs naturally in small amounts in the soils and rocks surrounding some homes. This gas occurs in extremely low concentrations in air outdoors, but may become concentrated in air-tight homes and other buildings. Radon enters buildings through cracks in walls and foundations, sumps and floor drains. Exposure to high concentrations of radon over long periods of time may increase the chances of developing lung cancer.

The New Mexico Environment Department (NMED), formerly the New Mexico Environmental Improvement Division (NMEID), has tested several thousand homes throughout New Mexico and found elevated levels of indoor radon in some homes. It is difficult to predict where indoor radon may be a problem. The only way to determine whether radon is present in dangerous amounts is to test your home. Special equipment is needed to detect radon, but two popular radon detectors are available at low cost at your hardware store. These are the charcoal canisters (approximately $10 - $25) and the alpha detectors (approximately $20 - $50). After testing, these devices are sent by mail to obtain test results. There are other radon detectors that require operation by trained professionals.

If your home has high levels of indoor radon, several easy, low-cost methods are available to rid your home of this unwanted visitor. Simple techniques such as caulking and sealing cracks may reduce most indoor radon levels. Other techniques may require special experts. Typical costs of reducing indoor radon levels are comparable to the cost of many other home repairs.

October 18-24, 1992 is "**National Radon Action Week.**" The New Mexico Environment Department, Environmental Protection Agency, and other agencies are urging everyone to test their homes for radon. These agencies are providing information on how to test for radon and how to correct radon problems.

For more information, call or write:

New Mexico Environment Department
Ron Mitchell, Environmental Scientist
1190 St. Francis Dr., P.O. Box 26110
Santa Fe, NM 87502 (505) 827-4300

Environmental Protection Agency
1-800-SOS-RADON

or read:

Environmental Protection Agency (EPA) 1986, A Citizen's Guide to Radon: EPA-86-004, Washington D.C.

Environmental Protection Agency, 1986, Radon Reduction Methods, a Homeowner's Guide: U.S. Health and Human Services Department, OPA-96-005, 24 pp.

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high LITES

EARTH SCIENCE UPDATE

Upcoming Geological Events

October 18-24, 1992
National Radon Action Week.
Call 1-(800) SOS-RADON for information on how to test your home.

November 5-6, 1992
37th Annual New Mexico Water Conference, Taos. Contact the New Mexico Water Resource Research Institute, (505) 646-5367.

November 14-15, 1992
13th Annual New Mexico Mineral Symposium, Socorro, New Mexico. Contact Judy Vaiza, NMBM&MR, (505) 835-5302 for registration or other information.

November 20, 1992
New Mexico Geographic Information Council Fall Meeting, at the Continuing Education Center of the University of New Mexico, at 1634 University Blvd. NE, Albuquerque. Contact Amy Budge, (505) 277-3622.

Teachers' Reading List: Earth Science Content Planning Guides

Earth Science Content Guidelines Grades K-12
Contains a set of questions to guide the inclusion of earth science content into the K-12 curriculum. Content areas include: Solid Earth, Water, Air, Ice, Life, and Earth in Space. Organized by content area, and divided into grade levels K-3, 3-6, 6-9, 9-12. Paperback, 80 pp., published Aug. 1991.
Item no. 329 **$15.00 plus shipping**

Earth Science Education for the 21st Century: A Planning Guide
Provides goals to guide the development of K-12 earth science curricula, essential concepts to understanding the Earth and its interacting systems, recommendations for teaching earth science subject matter and for implementing new earth science curricula in schools. Paperback, 40 pp., published Feb. 1991.
Item no. 327 **$10.00 plus shipping**

To order the above publications, contact the American Geological Institute (AGI) at AGI Publications Center, P.O. Box 205, Annapolis Junction, MD, 20701, phone (301) 953-1744.

Also, American Geological Institute offers a free pamphlet ***Careers in the Geosciences***. This pamphlet describes what geoscientists do, where they work, future job prospects, salaries, and where to find more information. To order, contact the National Center for Earth Science Education, American Geological Institute, 4220 King Street, Alexandria, VA 22302-1507.

what is....

Earthlight?
The faint illumination of the dark side of the moon caused by sunlight reflected onto the moon from the Earth's surface and atmosphere. Earthlight is most easily seen during the crescent phases of the moon.

Aquifer?
Soil or rock that is sufficiently permeable to conduct groundwater and to yield economically significant quantities of water to wells and springs.

Paleolithic?
An archeological term for the first division of the Stone Age, characterized by the appearance of man and man-made implements.

__Reference__-Bates, R. L., and Jackson, J. A. (editors), 1980, Glossary of geology: American Geological Institute, Alexandria, VA, 2nd edition, 749 pp.

"There is something fascinating about science. One gets such wholesale returns of conjecture out of such a trifling investment of fact."

Mark Twain, writing about geology in *Life on the Mississippi* .

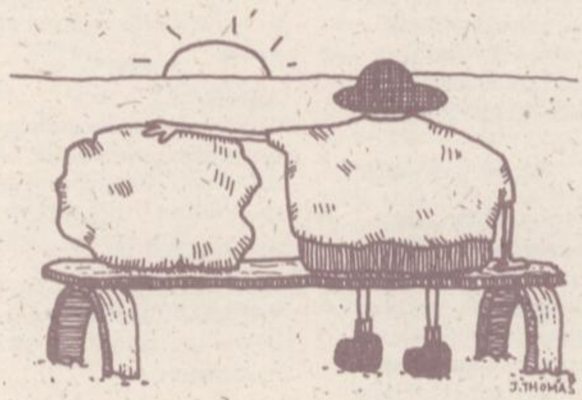
"...Obviously there are no well qualified students of the Earth, and all of us, in different degrees, dig our own small specialised holes and sit in them."

Bullard, E.C. (1960) Response to award of Arthur L. Day medal, Proc. Vol. for 1954, Geol. Soc. Am., p. 92.

greetings from the editorial staff...

The staff of *Lite Geology* would like to welcome its readers to the first issue, Fall 1992. The purpose of this publication is to present timely and relevant geological information in an easily understood, fun-to-read format. *Lite Geology* is less technical than our regular publications, and is directed towards educators and members of the public who have an interest in earth science. Whenever possible, supporting activities such as games, experiments, etc., that should appeal to students will be included in our format. Our broader mission is to help build earth science awareness in people of all age groups and of various interests, so please share *Lite Geology* with a friend. We encourage the submission of short articles, experiments, cartoons, quotes, etc., that may help earth science education. Also, please let us know how you like *Lite Geology*. For a free subscription, please contact the publications office.

Susan J. Welch
Editor, *Lite Geology*



LITE geology

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