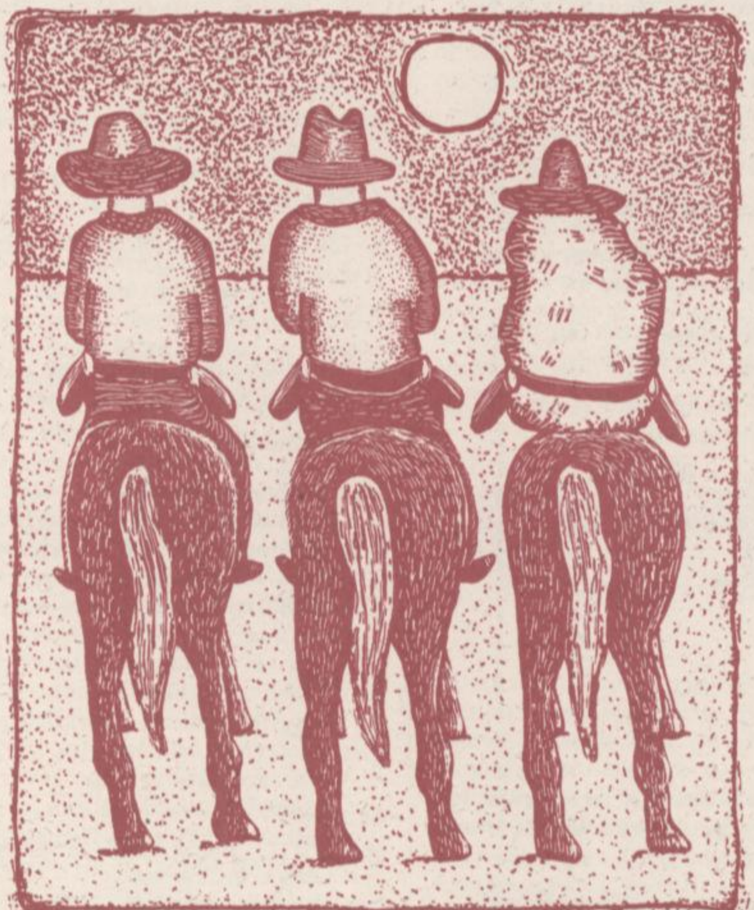
Winter 1992

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)



The good, the bad, and the ultramafic

This Issue:

Earth Briefs

Scientists Study Clay for Cleanup

Researchers at the University of New Mexico and Los Alamos National Laboratory have discovered a safe and effective way to remove trace amounts of radioactive plutonium from surface water—by treating it with clay. By the process of sorption, the clay attracts and collects radioactive materials in contaminated water, and by flocculation, the clay materials bind together and settle to the bottom where they can be easily separated from the water.

Both sorption and flocculation are pre-existing scientific concepts, but using the techniques together to remove plutonium from water is a new process. In the lab, the treatment has been shown to be 98% effective, but according to UNM's Eric Nuttall, its effectiveness in real-life situations has yet to be tested. Still, the treatment is an example of the ways existing technology can be used to combat environmental problems.

UNM Daily Lobo, 1992, issue for August 31, 1992: University of New Mexico, Albuquerque, New Mexico.

Water Guardians Program

You can adopt a waterway in New Mexico. The Surface Water Quality Bureau has less than 15 staff members in charge of field work for all of New Mexico's 6,000 miles of rivers and 150,000 acres of lakes. Consequently, volunteers are needed to check on specific water areas on a regular basis, and to supply information about these areas to the Surface Water Quality Bureau. There are no fees, and there are no required activities. Volunteers are free to do as much or as little as they wish. For information on how to adopt a waterway, please contact Bonney Hughes, Surface Water Quality Bureau, P.O. Box 26110, Santa Fe, NM 87502, or call (505) 827-2796.

rock hound

Quiet Desert was Once Site of Enormous Volcanoes

Nancy McMillan, an associate professor of geology at New Mexico State University, is attempting to reconstruct the landscape of southern New Mexico between 50 million and three million years ago. Apparently, the region was extremely active volcanically, active enough to "make Mount St. Helens look like a mere burp," according to McMillan.

Research done by McMillan under a grant from the National Science Foundation suggests that the rugged New Mexican landscape we see today was created millions of years ago in an explosive, fiery cataclysm caused by the melting of the earth's crust and mantle. McMillan says, "Changes in the style of volcanic activity are important clues in understanding the earth's crust in southern New Mexico."

Las Cruces Sun-News, 1992, issue for September 8, 1992: Las Cruces, New Mexico.

--Compiled by Toby Click

New Mexico's Resources Trivia Quiz

How many of the following questions about New Mexico's resources can you answer correctly?

1: What landform has the highest elevation in New Mexico (13,161 ft)?

2: What landform has the lowest elevation in New Mexico (2,817 ft)?

3: What size is the largest room in Carlsbad Caverns?

4: Who discovered Carlsbad Caverns?

5: Where in New Mexico can natural ice be found at any time of the year?

6: How many square miles are there in the state of New Mexico?

7: Which of the following raw materials are present in a skateboard?
a. Iron
b. Aluminum
c. Wollastonite
d. Calcium
e. Carbonate
f. Clay
g. Sulfur
h. Silica
i. Talc
j. Mica
k. Coal

8: How many barrels of oil and cubic feet of natural gas were produced in New Mexico during 1991?

9: How much money did the state of New Mexico receive in 1991 from oil and gas production taxes and royalties?

10: What is New Mexico's ranking in coal production in the United States and how many tons of coal are produced in New Mexico?

11: Approximately what percentage of the land in the western United States is owned by the Federal Government?

12: What is the average annual per capita consumption of new minerals in America?

answers

1. Wheeler Peak
2. Red Bluff Reservoir
3. Carlsbad Caverns contains the largest natural cave room in the world, measuring 300 ft by 300 ft by 1500 ft long.
4. Jim White, a cowboy, in 1901
5. the Ice Cave south of Grants, New Mexico
6. 121,666 square miles, the 5th largest state in the U.S.
7. all of the above
8. 70.4 million barrels of oil and 1.02 trillion cubic feet of natural gas
9. $299 million
10. New Mexico ranks 13th in coal production. Wyoming is the number one producer of coal in the United States. New Mexico has produced over 20 million tons for each of the past four years.
11. 50%
12. 40,000 lbs.

References

Mining at Play, poster, Australian Mining Industry Council (question 7).

New Mexico Bureau of Mines and Mineral Resources staff, 1992, personal communications (questions 8-12).

Travel adventures and trivia map, 1985: Map Incorporated, Norman, Oklahoma (questions 1-6).

Teachers' Note: This quiz would be useful as an extra credit exercise, or for use in learning centers or group activities.

Ground-Water Concepts for Understanding New Mexico's Water Supply

C. Stephen Haase
Ground-water Geologist, NMBM&MR

In contrast to **surface water** in lakes, streams and rivers, **ground water** remains hidden from view, and is the subject of uncertainty and myth. A scientific understanding of ground water is crucial to New Mexico, however, because over 90 percent of the state's population has its domestic water needs supplied by this resource. Ground water also is a major source of water used in agriculture, manufacturing, and mining throughout New Mexico and much of the southwestern United States.

Most ground water originates as rainfall that percolates downward through the soil. Surface water also can drain downward through lake or stream beds to **recharge** ground water. In general, ground water and surface water are intricately related, and the two systems are mutually dependent. In addition to being recharged by surface water, ground water can **discharge** into surface-water bodies at springs, seeps, and wetland or marsh areas.

To the nongeologist, ground water is commonly thought to occur in underground pools, lakes or rivers flowing in the subsurface, mimicking the readily observable behavior of surface water. Actually, ground water occupies small voids, called pores, or crevices, such as cracks and fractures, found in subsurface materials. With the rare exception of caves, ground water never occurs in pools or rivers.

Aquifers are water-saturated geological formations that serve as sources of ground water. The household sponge provides a convenient model of an aquifer. The sponge contains a framework of solid fabric that surrounds a network of open spaces or pores. These pores store water when the sponge is wet; most water in the sponge occurs within the pores, and relatively little enters the framework itself. Similar to the sponge, an aquifer contains open space, which may be simply the free space between constituent grains that compose the framework of the aquifer. The open space also may consist of fractures and breaks in the framework, or crevices where a small portion of the aquifer framework has been dissolved away. **Porosity** is a measure, expressed as a percentage, of the amount of free space available for ground-water storage within an aquifer. Good aquifers typically have 10 to 20 percent porosity; an exceptional aquifer may have a porosity of up to 40 percent.

Ground water within a specific portion of an aquifer contains a given amount of energy, referred to as **hydraulic head**. The hydraulic head of ground water at a given point within an aquifer depends on the elevation and the pressure exerted on the ground water by surrounding water within the aquifer. Hydraulic head is expressed in units of length, such as feet, above a reference point. Sea level is the most frequently used reference point for hydraulic-head measurements. Within an aquifer, hydraulic head is variable, and ground water moves from areas of high hydraulic head, e.g. recharge zones, to areas of low hydraulic head, e.g. discharge zones. Unlike many ground-water properties, hydraulic head can be readily observed and measured; it is the **water level** within a well at a specific point in an aquifer.

Factors that control the rate of water movement through an aquifer include the **hydraulic conductivity**, and the magnitude of hydraulic head differences between different portions of an aquifer. Hydraulic conductivity is a measure of the ease with which water moves through an aquifer. It is a complex function of the shape, distribution, and connectivity of the pore spaces in an aquifer. Hydraulic conductivity is expressed in units of length/time, such as feet/sec; the greater the hydraulic conductivity of an aquifer, the more easily ground water flows through it.

Within aquifers composed of **unconsolidated** sand and gravel, the pore space consists of space between the individual sand and gravel grains. The size and shape of the **constituent** grains influence the nature of porosity and hydraulic conductivity within unconsolidated aquifers. **Consolidated** aquifers form when grains of unconsolidated aquifers become cemented together, which can occur in response to heat, pressure, and precipitated minerals developed during deformation or burial of unconsolidated sands, gravels, or other types of sediments. In consolidated aquifers, fractures, cracks, and small channels formed by dissolution of aquifer material determine an aquifer's porosity and hydraulic conductivity.

New Mexico contains a variety of aquifers. Along the Rio Grande, a series of deep basins contain deposits of silt, sand, gravel, and some clay. Aquifers in these basins consist of unconsolidated beds of sand and gravel that were washed into the basins from adjoining mountains, such as the Sandia Mountains near Albuquerque, and by the ancestral precursors to the present-day Rio Grande. Two of these basins, the Albuquerque Basin centered in Bernalillo County and the Mesilla Basin in Doña Ana County provide all of the domestic water for New Mexico's largest metropolitan areas. Elsewhere in the state, sandstone aquifers, such as in the San Juan Basin, and limestone aquifers, as in the Roswell-Artesia Basin are examples of consolidated bedrock aquifers. Both the San Juan Basin sandstones and the limestones of the Roswell-Artesia Basin are important sources of ground water.

Suggested references

Fetter, C. W., 1988. Applied Hydrogeology, Charles Merrill Publishing Company, Columbus, Ohio, 2nd edition, 592 pp.

U. S. Geological Survey, 1965. Mineral and water resources of New Mexico. New Mexico Bureau of Mines and Mineral Resources Bulletin 87, 437 pp.

The Economic Benefits of the Mineral Industry in New Mexico

Chuck Chapin
NMBM&MR Director
Frank Kottlowski
NMBM&MR Emeritus Director

What is an extractive mineral?

Everything used by our modern civilization is either grown or extracted in some form from our Earth. Extractive minerals are obtained by mines and quarries, evaporation of natural waters, or through wells that produce oil, various gases, molten sulfur, water, or minerals in solution.

Although the food we eat is grown, it is made available through the use of mineral products. Without fertilizers, or metal for farm machines and tools, metal for eating and cooking utensils, metal and petroleum-based plastics for refrigeration, or clay and feldspar for dishes, we would not have much to eat. For clothing, metal is needed for machines to plant and harvest cotton, to manufacture cloth from both natural and synthetic (petroleum-based) fibers, and to produce sewing implements such as scissors and needles. Our homes and other buildings are made of concrete, metal lath, gypsum board, plaster, copper wire, and other materials extracted from the earth. The many items we consume are transported by metal trucks over asphalt roads, or by metal trains along metal tracks.

Without extractive minerals, we would have little of the food, clothing or shelter that we enjoy in our modern culture. Even the early Native Americans used extractive minerals such as chert for arrowheads, adobe and stone for walls, clay for pots, and turquoise, copper, and gold for jewelry.

How does New Mexico depend on the extractive mineral industries for revenue?

New Mexico's extractive mineral industries contributed approximately one-third of the State's $1.9 billion general fund income in Fiscal Year 1991 (ending June 30, 1991). Approximately $566 million came from taxes, royalties, and permanent fund earnings attributable to oil and gas production. An additional estimated $70 million came from taxes and royalties paid by the metals, coal, and industrial minerals mining industry.

How much extractive minerals do we produce?

In 1991, New Mexico production ranked fourth in the Nation for natural gas, seventh in oil, and tenth in nonfuel minerals. The combined value of oil and gas production was $2.8 billion while nonfuel minerals contributed about $1 billion and coal $509 million. New Mexico ranked first in the Nation in production of potash ($250 million) and perlite (estimated $14 million) and was second in copper ($714 million in 1990) and carbon dioxide ($34.7 million). The State also produces important quantities of gold, silver, zinc, mica, pumice, salt, dimension stone, cement, gypsum, clay, and sand and gravel.

How does this money benefit the people in New Mexico?

Severance taxes and royalties from production of fuels and minerals have built the State's two permanent funds that now total approximately $5.6 billion. *The $391 million earned by these funds in 1991 was used to finance education and other public services. In addition, during Fiscal Year 1991, payments to New Mexico from Federal royalties and leases were $107 million, all earmarked for public education.*

What additional funds are generated by the extractive mineral industry in New Mexico?

New Mexico's extractive mineral industries provided property and corporate income taxes while their 17,000 direct employees in 1991 contributed personal income taxes from $518 million in earnings. Local sales taxes, large electric utility payments and many purchases from other New Mexico businesses added to the financial benefit.

Do these revenues impact all citizens in New Mexico?

The multiplier effect of dispersal of these monies through local and state economies increases their impact manyfold. Thus, maintaining a healthy mineral industry is vitally important to all of us. With a population of about 1,500,000 people in the State, each man, woman, and child would need to pay about $450 more in taxes if we had no extractive mineral industry.

(Sources of data: New Mexico Energy, Minerals and Natural Resources Department; U.S. Bureau of Mines; New Mexico Oil and Gas Association)

Nepheline Syenite: Toilet Bowls and Beer Bottles

Virginia T. McLemore
Economic Geologist, NMBM&MR
James Guilinger
Geologist, Addwest Minerals, Inc., Arvada, CO

What do **nepheline syenite**, toilet bowls, and beer bottles have in common? Did you know that everyone uses products made from nepheline syenite every day? Nepheline syenite is used in manufacturing glass, pottery, and ceramics. Someday, nepheline syenite mined from the Cornudas Mountains, southern Otero County, New Mexico, may be used in making toilet bowls and amber-colored glass for beer and soda bottles . Other uses of nepheline syenite are in paints, rubber, plastics, stains, "soft" abrasives, metal primers, and sealers, and in foam-backed carpet. Nepheline syenite is a product known only by a few, but used by many.

What is nepheline syenite? Nepheline syenite is an igneous or **plutonic** rock predominantly composed of **feldspar** and **nepheline** with varying amounts of other **silicate** minerals. Nepheline syenite, unlike many igneous rocks, does not contain any **quartz**. Commercial deposits of nepheline syenite consist of greater than 60% feldspar, 20-25% nepheline, and normally less than 0.5% dark-colored minerals. Because a small amount of iron results in colored glass or ceramics, a commercial deposit usually must contain small amounts of iron minerals. In addition, the deposit must be near the Earth's surface so that cheaper open-pit mining can be used. Commercial deposits must be large, containing thousands of tons of nepheline syenite.

Recently, Addwest Minerals, Inc. from Arvada, CO, discovered that nepheline syenite in the Cornudas Mountains, Otero County, is suitable for making dark-colored ceramics and amber beverage bottles. The Cornudas nepheline syenite is one of several plutons in southern Otero County, but is the only one that tests show contains material suitable for glass and ceramics. The Cornudas nepheline syenite consists of nepheline, feldspar, and up to 10% iron-magnesium-rich, dark-colored minerals. These dark-colored minerals form a mineral aggregate that contains **magnetite**, and the entire aggregate can be separated from the crushed rock by a very strong magnet.

Once the dark minerals are removed, additional testing of rock characteristics such as ability to melt under low temperatures, hardness and tensile strength is necessary. Test results will be used to help determine which market can utilize the nepheline syenite. Marketing studies also are necessary to determine how much to produce and at what price the nepheline syenite can be sold.

Finding and testing the nepheline syenite is only the first step in starting a mine. State and federal permits must be obtained. An archeologist must examine the area to be mined. Archeological sites, such as Indian shelters and areas of broken pottery and arrowheads, indicating evidence of early inhabitants' activities will be protected from mining so that they can be studied by future generations. After marketing studies are finalized, a mine plan is developed based on the amount of nepheline syenite that can be sold. If all criteria are met, Addwest Minerals, Inc. will start mining. In a few years the toilet bowl in your house or some of your beverage bottles may be made from nepheline syenite mined right here in New Mexico.

Glossary of Mineral Terms

Aluminosilicate-*A compound containing aluminum, silica and oxygen.*

Feldspar-*A group of abundant rock-forming minerals found in all types of rocks. They are usually white to colorless to pink, and occur as lath-like crystals.*

Feldspathoid-*Rare rock-forming minerals consisting of* ***aluminosilicates*** *and having relatively low silica contents.*

Magnetite-*A black, opaque mineral that is strongly magnetic (attracted by a magnet), relative to other minerals. Magnetite is composed of iron and oxygen.*

Nepheline-*A mineral of the* ***feldspathoid*** *group with the chemical formula (Na, K) $AlSiO_4$. Nepheline occurs as glassy-looking crystals or grains.*

Nepheline Syenite-*A plutonic igneous crystalline rock composed of feldspar and nepheline.*

Pluton-*An igneous intrusion.*

Silicate-*A compound consisting, in part, of silica and oxygen.*

Quartz-*A silicate mineral with the chemical formula SiO_2.*

References

Minnes, D. G., Lefond, S. J., and Blair, R., 1983, Nepheline Syenite; *in* Lefond, S. J., ed., Industrial minerals and rocks: American Institute of Mining, Metallurgical, and Petroleum Engineers, Inc., New York, pp. 931-960.

Harben, P., 1979, Nepheline syenite: Industrial Minerals, September 1979, pp. 71-77.

Robbins, J., 1986, Feldspar and nepheline syenite, filling a need?: Industrial Minerals, September 1986, pp. 69-101.

Harben, P.W., and Bates, R.L., 1990, Industrial minerals–geology and world deposits: Industrial Minerals Division, Metal Bulletin PLC, London.

Natural Resources and Your Christmas Tree

Doug Jones
Student, Department of Geosciences, New Mexico Institute of Mining and Technology
Virginia T. McLemore
Economic Geologist, NMBM&MR

This holiday season, the last thing on our minds is the natural resources that bring such pleasure to the season. The lights, decorations, glitter on greeting cards, and wrapping paper add to the excitement of the holidays, but perhaps the image of the Christmas tree is the most memorable of all. Have you ever thought about the raw materials that bring together this image? The majority of these raw materials were furnished by the mining and petroleum industries.

Although many New Mexicans drive to the forest to cut Christmas trees, most Christmas trees are grown on tree farms. Like all crops, the trees are grown with fertilizers. About half of the world's production of sulfur and over 90% of the production of phosphates and potash go into fertilizers, of which the sapling trees receive a share. Surface and ground water resources are also needed for the growth of the trees.

Strands of tiny lights have replaced candles on the trees, adding to the list of minerals that bring holiday cheer. The wires are made of copper; the insulation and wall plug are formed by the combination of petrochemicals with pumice, limestone, marble, vermiculite, silica, feldspar, or trona. The glass bulbs contain feldspar, silica, clay, nepheline syenite and trona; filaments in the bulbs are made of thin conductive strips of tungsten metal, which comes from the minerals scheelite and wolframite.

The glittering tree ornaments are made from a variety of materials. Plastic ornaments contain petrochemicals; ceramic and glass ornaments are made of ingredients similar to light bulbs, and also contain borates, and metals such as iron, copper, and lead. The star at the top of the tree could be made from either aluminum, silver, or copper. The ornament hangers and tree stand also are typically a metal alloy containing iron or aluminum. Colorful paints and glazes used to decorate the ornaments are based on petrochemicals, mica or clay, and are pigmented with ingredients such as lithium found in spodumene, titanium in rutile, manganese in pyrolusite, and rare-earth elements in uncommon minerals. The papers and woods that the paints are applied to commonly contain clay as an additive or filler.

Well over 20 different raw materials are used to create a decorated Christmas tree. And what about the natural resources that go into the gifts, or the electricity to light the tree? Wow!

Quiz

Listed below are some items often associated with a Christmas tree, and some raw materials that could be used to make these items. **In the blanks, write the letters of some of the raw materials** used to make each item on the tree. Refer to the key for some possible answers.

Christmas Tree Items

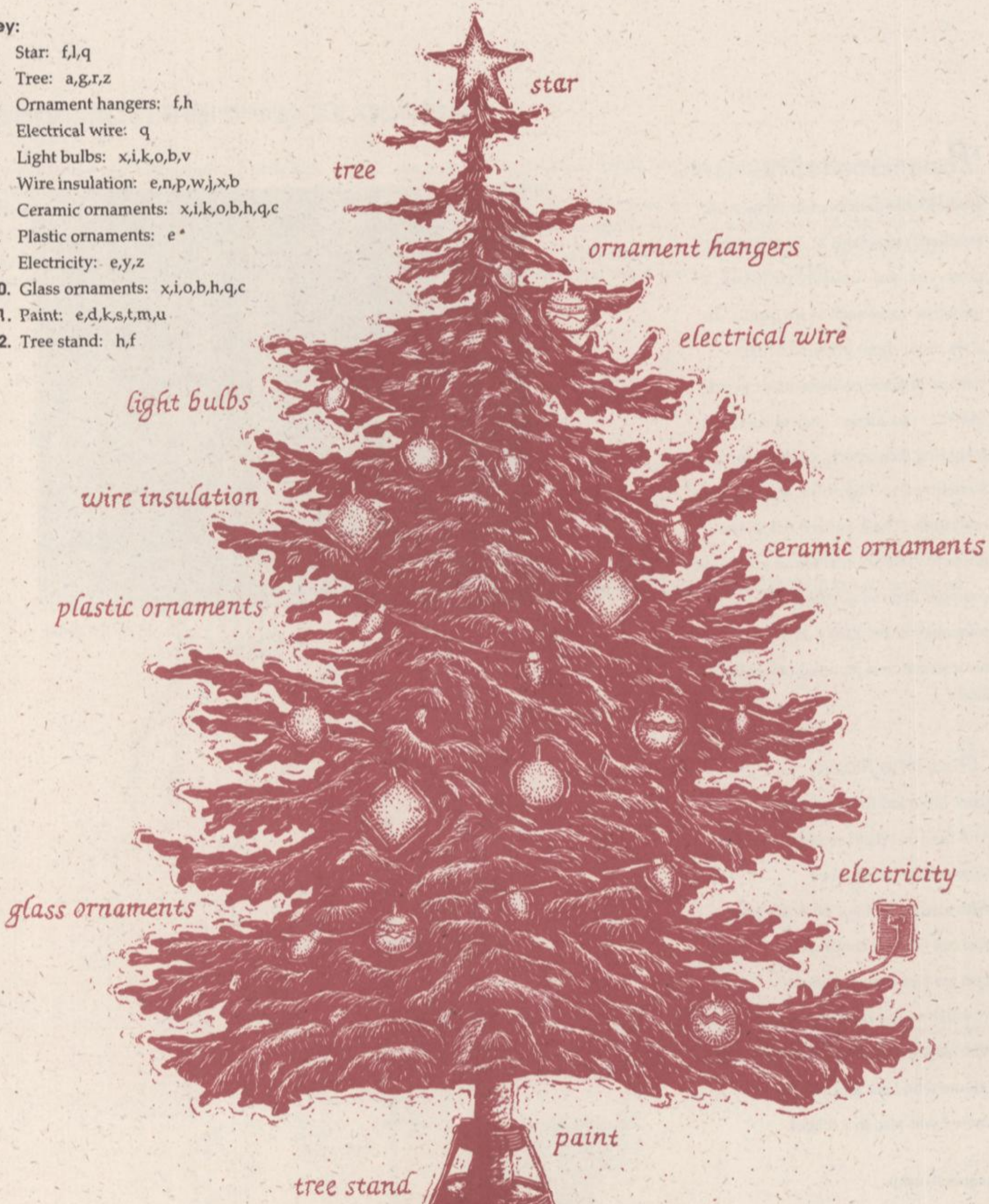
1. Star________________
2. Tree________________
3. Ornament hangers________________
4. Electrical wire________________
5. Light bulbs________________
6. Wire insulation________________
7. Ceramic ornaments________________
8. Plastic ornaments________________
9. Electricity________________
10. Glass ornaments________________
11. Paint________________
12. Tree stand________________

Raw Materials

a. Sulfur
b. Trona
c. Lead
d. Mica
e. Petrochemicals, oil, natural gas
f. Aluminum
g. Potash
h. Iron
i. Silica
j. Vermiculite
k. Clays
l. Silver
m. Manganese
n. Pumice
o. Nepheline syenite
p. Limestone
q. Copper
r. Phosphates
s. Lithium
t. Titanium
u. Rare-earth elements
v. Tungsten
w. Marble
x. Feldspar
y. Coal
z. Water

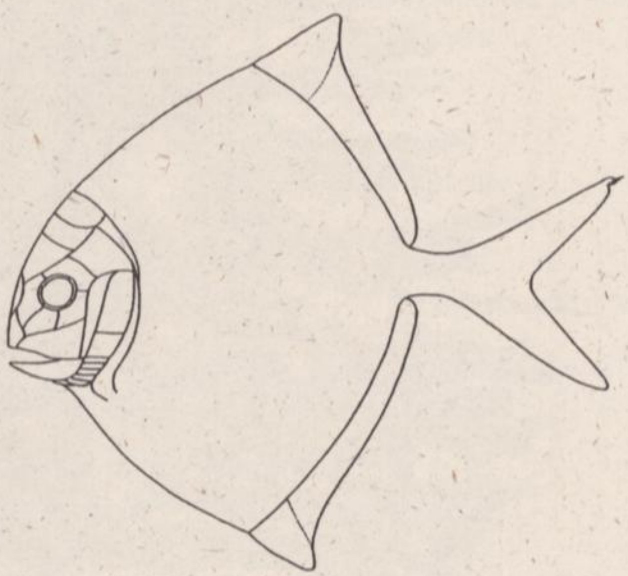
Key:

1. Star: f,l,q
2. Tree: a,g,r,z
3. Ornament hangers: f,h
4. Electrical wire: q
5. Light bulbs: x,i,k,o,b,v
6. Wire insulation: e,n,p,w,j,x,b
7. Ceramic ornaments: x,i,k,o,b,h,q,c
8. Plastic ornaments: e *
9. Electricity: e,y,z
10. Glass ornaments: x,i,o,b,h,q,c
11. Paint: e,d,k,s,t,m,u
12. Tree stand: h,f



Paleontologists are scientists who study fossils preserved in rocks. Most fossilized organisms are incompletely preserved, and consist of parts such as bones, or traces such as footprints. To learn more about prehistoric life, paleontologists use these fossil puzzle pieces to reconstruct ancient creatures including fish, insects, or dinosaurs. Sometimes, identification of a fossil is a real riddle. The fossilized fish in the photo to the right was found in its nearly complete state by *NMBM&MR paleontologist* **Jiri Zidek**. His reconstruction is pictured below the fossil.

photo by Jiri Zidek



Bed-Time Riddle

Once I roamed the sunny shore
And then one day I roamed no more
Now I sleep inside a bed
With sandy blankets 'bove my head
You can find me coming out
And see I've changed about
As much as any creature might
Who slept a thousand years each night
Tell me who I am and you'll
Know I was also in a school

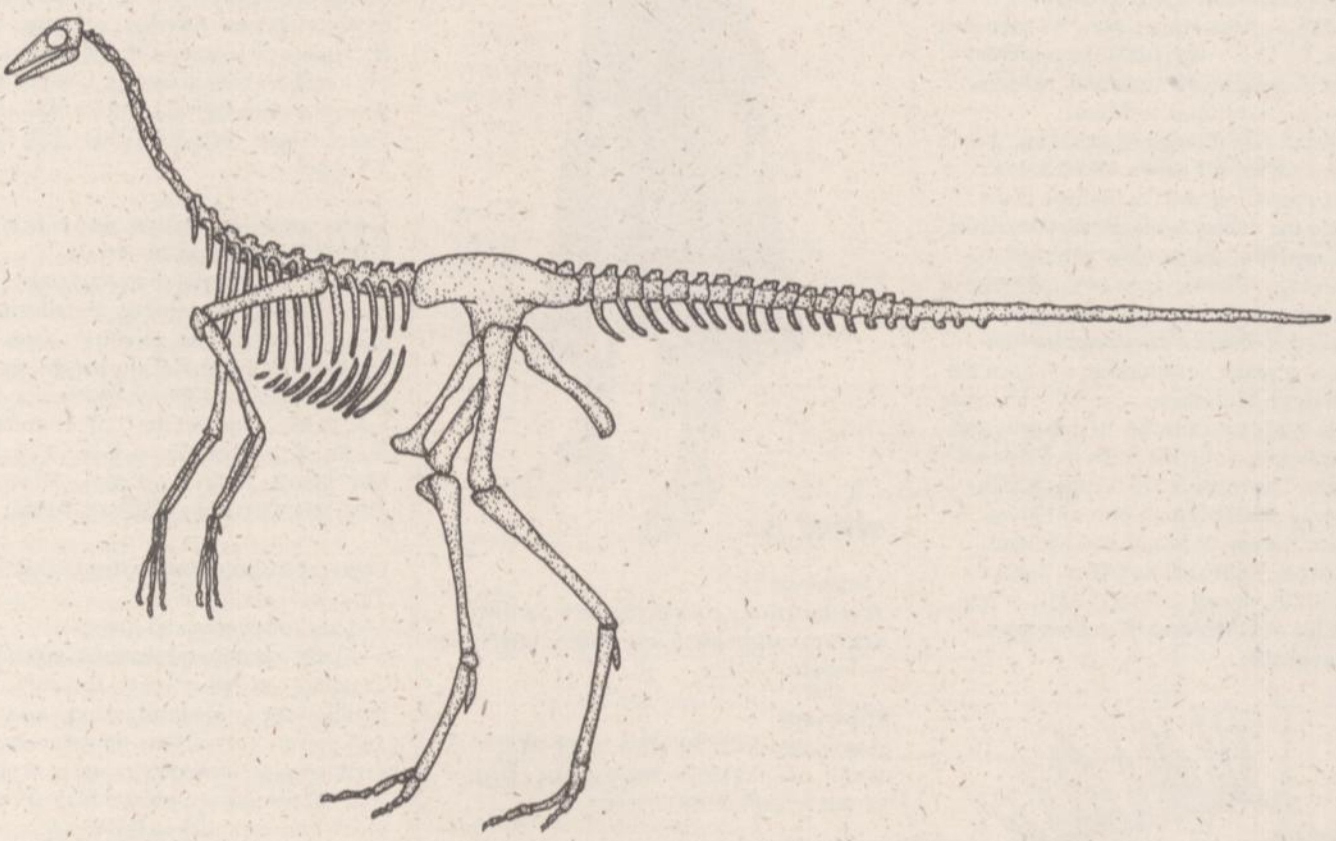
Jacques Renault
Senior Geologist, NMBM&MR

Reconstruct the dinosaur contest !

What do you think this dinosaur *really* looked like? You may use any materials (paint, crayons, paper mache, sticks, buttons etc.) for your reconstruction. The only requirement is to be creative and have fun!

Your dinosaur will be on display at the New Mexico Tech Macey Center during the Science Fair, April 16-17. Local artists will judge the contest, and will present ribbons for places 1-5. We will show the winning dinosaurs in a coming issue of *Lite Geology*.

Mail to: New Mexico Bureau of Mines and Mineral Resources, Attn. Susan Welch, Socorro, NM 87801. Include: Name, Address, Age, School. Deadline: April 7. If you would like to have your dinosaurs returned–please enclose a self-addressed, stamped envelope (or box).



Information about this skeleton provided by Spencer Lucas, NM Natural History Museum.

reconstruction of a housecat

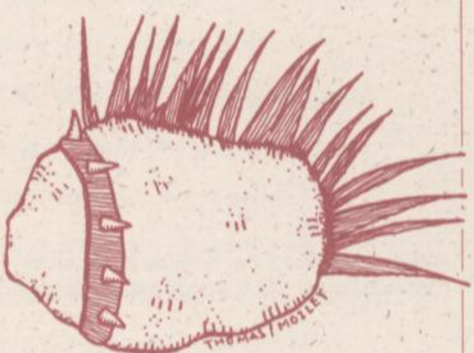
high LITES

EARTH SCIENCE UPDATE

publications profile...

A popular NMBM&MR publication reprinted in 1992 will be of interest to **spelunkers** (those who explore caves as a hobby)...

Bulletin 117—Geology of Carlsbad Cavern and other caves in the Guadalupe Mountains, New Mexico and Texas, by C. A. Hill, 1987, 150 pp. This bulletin appeals to a variety of readers. Although it contains technical information of interest to scientists, it is also useful for the caver who wants to better appreciate the Guadalupe caves, and for the visitor to Carlsbad Cavern as an interpretive guide to its geology and mineralogy. Photographs of most types of cave deposits and speleothems are included so that the caver can use the book as a guide to numerous caves in the Guadalupe Mountains. Specific reference also is made to a number of deposits and speleothems along the trails in Carlsbad Cavern. The price is $15.00 plus $2.50 shipping. Mail prepaid order to New Mexico Bureau of Mines and Mineral Resources, Publications Office, Socorro, NM 87801, or call (505) 835-5410. A free price list of NMBM&MR publications is also available.



punk rock

what is...

Limestone?
A sedimentary rock composed chiefly of calcium carbonate. Limestone is often rich in fossils.

Riparian?
Associated with the bank of a body of water, or situated on the bank of a body of water, especially a river.

Speleothem?
A mineral deposit formed in a cave by the action of water. Some examples of speleothems include stalactites, which are deposited on cave ceilings, and stalagmites, which form on cave floors.

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

Teachers' Resources: Free Lists of Earth Science Educational Materials

Earth Science Resources for Teachers 1992
This listing includes 53 nonprofit sources of precollege earth science reference and instructional materials, many of which are available free of charge. Contact the American Geological Institute, 4220 King Street, Alexandria, VA 22302-1507, (703) 379-2480.

Government, Education, and Mining (GEM) Educational Materials
A list of educational materials published by the Society for Mining, Metallurgy and Exploration, Inc. (SME) features free teachers' training packets, brochures, and booklets, along with information on low-cost videos. Contact the SME Foundation for Public Information & Education, Inc., 8307 Shaffer Pkwy., Littleton, CO 80127, (303) 973-9550 or Fax (303) 973-3845.

Mineral Information Institute (MII) Teachers' Materials
MII has references and materials available for mineral resource education. Teachers can call or write, and should mention the grade level, subject taught, and the amount of class time devoted to earth science. Materials range in scope from 20-minute supplements to several-week-long modules to full-year programs. Contact the MII at (303) 297-3226 or Mineral Information Institute, 1125 17th Street, Suite 1800, Denver, CO 80202.

Also...
Stones and Bones, a quarterly, fold-out activity sheet for ages 6-12 is available for free by contacting Anasazi Heritage Canter, 27501 Highway 184, Dolores, CO 81323.

Mighty Minerals, a teaching unit for 3rd and 4th grade classes is available for free by sending a letter on school letterhead to the Northwest Mining Association, 414 Peyton Building, Spokane, WA 99201, (509) 624-1158.

Rocks and Minerals and How We Use Them is a new 23" x 35" poster for sale by the National Energy Foundation (NEF). The whimsically drawn illustrations depict various mining operations, transportation of minerals to market, and end-product uses. The posters are available for $3.00 plus handling. Also available is a book, **Mining Glossary and Games** for $5.00 plus handling. Handling charges are 10% of order total, or a $3.00 minimum charge. Prepaid orders can be mailed to the National Energy Foundation, 5160 Wiley Post Way, Suite 200, Salt Lake City, UT 84116. For more information, call NEF at (801) 539-1406.

Common Ground, an educational video produced by Caterpillar Inc., presents the story of the mineral products of our planet: what minerals are present in the products we use everyday, how they are formed, how and where they are found, their role in human civilization, and how we are managing and protecting our mineral resources and the environment. The 26-minute video along with teacher's and user's guides, is available for $10.00 from any Caterpillar Inc. equipment dealer. In New Mexico, phone Mark Wisdom, Rust Tractor Co., 1-(800) 468-5081, or if calling from Albuquerque, (505) 345-8411.

Upcoming Geological and Scientific Events

February 4-6, 1993
Riparian Conference, Albuquerque. Contact the Water Resources Research Center, (602) 792-9591 for registration or other information.

February 20, 1993
New Mexico Science Olympiad, New Mexico Tech Campus, Socorro, New Mexico. Contact Vannetta Perry, (505) 835-5678 for more information.

April 16-17, 1993
New Mexico Science & Engineering Fair, New Mexico Tech Campus, Socorro, New Mexico. Contact Vannetta Perry, (505) 835-5678, for more information.

New Mexico Regional Science and Engineering Fairs: 1993
(Regions, dates, *Directors*, and phone #)

San Juan: March 18-20
Mr. Gary Howe (505) 632-3633

Four Corners: March 11-13
Mr. Rex Robinson (505) 285-4677 (ext. 37)

Northeastern: March 6
Dr. Thomas Salazar (505) 454-3557

Northwestern: March 18-20
Mrs. Randi Buck (505) 277-4916

Southeastern: February 27
Dr. Michael Braunstein (505) 562-2309

Southwestern: March 6
Dr. Gordon Ewing (505) 646-3328

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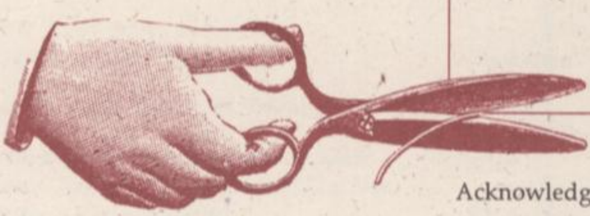

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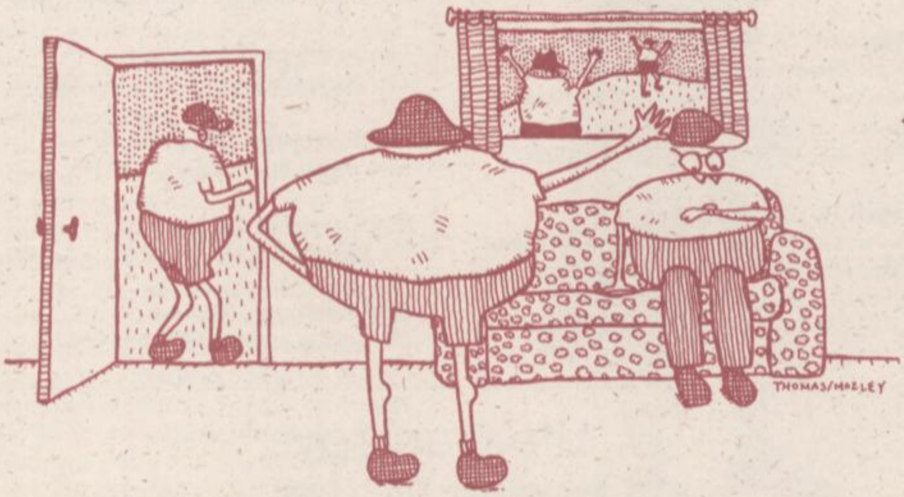
we want to hear from you...

The focus for this issue is on many of the natural resources in New Mexico, and how we enjoy, depend on, and benefit from these resources. We would like to have feedback from readers about the articles and other features in *Lite Geology*. Please write to us and request to see coverage of earth science topics that interest you. Also, we hope that teachers will share with us their special secrets and techniques for getting students interested in and excited about earth science. If you enjoy *Lite Geology* and would like to continue receiving it, we ask you to confirm your subscription by mailing in the subscription order form found within this issue. We hope that you have as much fun reading this publication as we do in producing it. Until next issue, our authors and staff will be writing, rewriting, cartooning, and waiting to hear from readers about how we can make *Lite Geology* even better.

Susan J. Welch
Editor, *Lite Geology*



Peter begins to describe the details of his research.

LITE geology

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Purpose: to help build earth science awareness by presenting educators and the public with contemporary geological 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 source.

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