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

*Photo credits: Penguin by Dr. Bill McIntosh, NMBMMR
Space shuttle photo of New Mexico by NASA*

Where on Earth would astronauts train to conduct geophysical studies on the surface and subsurface of Mars and other planets? Can scientists use field exploration techniques learned on Earth to support planetary exploration missions? What exactly do geophysical studies tell us about these other planets? Would NASA really send penguins to Mars? *Find the answers to these questions in the story on page 10.*

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Earth Briefs

Gas From Garbage: *An Alternative Energy Source*

Dr. Brian Brister
NMBMMR *Petroleum Geologist*

According to the U.S. Environmental Protection Agency (EPA), approximately 208 million tons of municipal solid waste was generated in the United States in 1995, averaging about 4.3 pounds per person per day. Although recycling has become an increasingly popular method of converting waste material into a useable product, about 70% of our garbage is currently considered non-recyclable and must be incinerated or deposited in landfills. Landfilled waste includes biodegradable paper, food waste, garden waste, textiles, and wood.

Anaerobic bacterial decomposition in the landfill environment creates three byproducts: solid residue, liquid leachate (primarily water), and landfill gas (LFG). Landfill engineers are challenged by the task of managing the liquid and gaseous byproducts that could be environmentally detrimental if not adequately contained.

LFG is composed of methane (approximately 55%) and carbon dioxide with traces of other gases. As LFG is generated, pressure builds up within sealed landfills. If LFG is not vented, serious explosions may result.

Unfortunately, LFG is composed of malodorous and polluting "greenhouse gases" that should not be vented to the atmosphere. In fact, landfills are the largest source of man-made methane in the U.S., accounting for almost 40% of those emissions. Landfills exceeding one million tons, an estimated 500 to 700 in number, will soon be required to install an active collection system to control emissions.

Methane is the major component of natural gas burned as a heating fuel and for generating electricity in many parts of the country. Fortunately, the methane content of LFG is sufficient for burning as an alternative fuel.

The EPA estimates that energy from landfills could power three million homes. Most major landfills are being fitted with LFG extraction wells and energy conversion equipment such as electric generating turbines.
Such projects are not limited to big east and west coast cities. In fact, it is foreseeable that the City of Albuquerque, New Mexico may some day develop a program to generate electricity from LFG that it currently flares.

World Wide Web Resources:

California Energy Commission http://energy.ca.gov/development/biomass/landfill_gas.htm

***City of Albuquerque, NM Solid Waste Division, Cerro Colorado Landfill** http://www.cabq.gov/solidwaste/cerro.html

US Department of Energy http://www.eren.doe.gov/consumerinfo/refbriefs/vg7.html

US Environmental Protection Agency http://www.epa.gov/epaoswer/osw/index.html

*Note: The ***Cerro Colorado Landfill*** in Albuquerque uses modern technologies and stringent oversight of its operations to ensure that their landfill is both cost efficient and environmentally safe. Visit the website listed above to learn how nearly 8,000 tons of trash each week are disposed of at the landfill, and the various methods used to keep the landfill environmentally sound.

Have You Ever Wondered...

Who "gets rich" when an oil well is drilled in New Mexico?

Dr. Brian S. Brister
NMBMMR *Petroleum Geologist*

This article examines basic economics of oil produced in the State of New Mexico, from what it costs to drill and produce an oil well to who benefits from the production. The answer to who "gets rich" may surprise you!

Oil: Business or bonanza?

Depending upon your vintage, you may remember James Dean's role in the movie "Giant" as the wildcatter who strikes a gushing fortune; or Beverly Hillbilly Jed Clampit "shootin' up some crude." Are these portrayals of easy riches accurate today? Many people believe that participation in a drilling venture is akin to a weekend in a casino.

All dreams of wealth aside, ask yourself this question: Is high-stakes gambling good business? Application of new technology and sound business management practices have reduced the risk faced by many oil companies today, but as in most things financial, less risk often equates to less reward. In fact, oil company stocks on the New York Stock Exchange are usually downright boring. In a way, the oil business in New Mexico today is a manufacturing business where the final product is a barrel of crude oil pumped from the ground and delivered to a tank. New Mexico oil operators produced approximately 150,343 barrels per day in December, 1999, according to the New Mexico Oil Conservation Division. This volume was less than 1% of the approximately 18.5 million barrels of oil per day needed by the United States, as reported by the American Petroleum Institute.

Shopping for bargain prices?

In order to understand the economics of oil, we need to understand what it is worth and why. Over the last decade, crude oil has averaged about $15.50 per barrel. Since a barrel of oil equals 42 US gallons, the average cost of a gallon of crude oil over that period was about 37 cents. Next time you are in the grocery store, compare this to the retail price of bottled drinking water. As of December 1999, the United States imports approximately 55% of the oil it needs, thus crude oil prices are subject to international pressures including political and economic crises, and surpluses or shortages of available oil. The price of crude oil varies daily and is determined by trading in international commodity markets well known for emotional responses to world news events, and far from Farmington or Roswell.

New Mexico oil producers do not set their own price, but rather are told what they will be paid relative to a **posted price** benchmark set by the market for the day. International markets suffer periods of "boom" and "bust" and likewise, the fortunes of New Mexico oil companies vary accordingly through time. The challenge to the New Mexico oil producers is to produce and sell their product, and try to make a profit, within a price structure over which they have little control.

There is a distinction between the **upstream** oil industry that produces the oil from the Earth, and the **downstream** industry that gathers, transports, refines, and distributes products to consumers. New Mexico's **independent** oil producers are upstream businesses. Although the focus here is the upstream industry, it is worth noting that downstream businesses (e.g. refineries, pipelines, service stations) are important to New Mexico as well. Most of us don't pay much attention to the price of barrels of crude oil, but we are very aware of prices of some refined goods, especially gasoline. Figure 1 lists common products refined from crude oil. Prices for crude oil and refined products are closely linked, although the problems of transportation to and from refineries, and the inventories (or lack thereof) of crude and refined products stored at refineries on any given day, may cause price disparities.

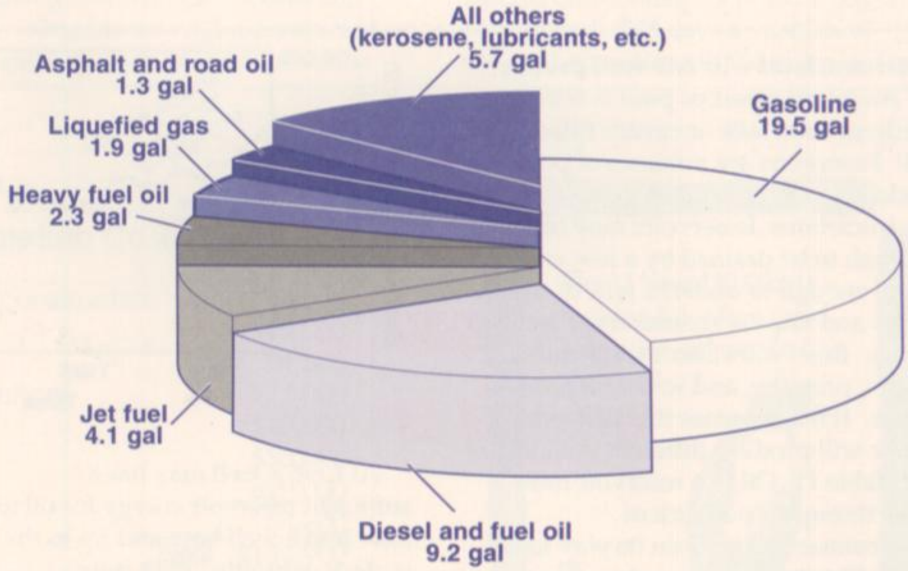


FIGURE 1—Pie diagram showing typical products and volumes refined from a barrel of crude oil (average yields for US refineries). One barrel of crude oil contains 42 gallons but yields 44 gallons of products. Statistics are from the American Petroleum Institute (http://www.api.org/edu/factsoil.htm).

Pool (geol. formation)	Nearby City	# of pumping wells (end of 1997)	1997 prod bo	Avg bo/day/pw	cumulative bo to 12-31-1997
Avalon (Delaware)	Carlsbad	40	310,950	21.3	3,980,154
Bisti (L. Gallup)	Farmington	153	233,958	4.2	24,849,728
Dagger Draw (U. Penn, N)	Artesia	226	4,899,526	59.4	39,888,806
Eunice Monument (Grayburg-San Andres)	Eunice	439	2,269,665	14	330,518,905
Hobbs (Grayburg-San Andres)	Hobbs	230	2,833,479	33.7	316,360,985
Vacuum (Abo, N)	Lovington	169	1,293,585	21.0	48,044,012

TABLE 1—Production statistics for selected New Mexico oil fields. **fm**=geological formation, **pw**=pumping well, **bo**=barrels of oil.

How much oil will one well produce?

An oil **reservoir** or **pool** is not an underground lake or cavern filled with oil! Reservoirs are volumes of porous rocks containing crude oil or other hydrocarbons. Reservoirs may be small enough to be drained by a few wells, or large enough to underlie tens of square miles and require thousands of wells to drain. Reservoirs also vary greatly in depth, pressure, and rock and pore types. It makes sense that different pools will produce different amounts of oil (Table 1). Oil in a reservoir must pass through a network of interconnected pores on its way to a well. This takes time and requires some driving physical force, called **reservoir energy**, to keep it moving (i.e. pressure or gravity). The rate at which oil can be withdrawn is very important to the economic viability of the well.

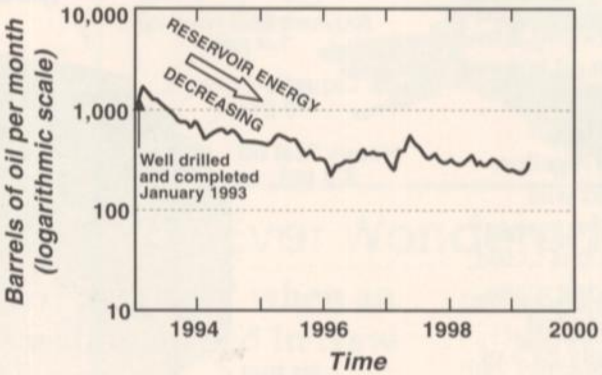


FIGURE 2—Production decline curve for a hypothetical "shallow" (3500 feet deep) oil well drilled in 1993 in southeast New Mexico near Artesia.

At first, a well may have sufficient reservoir energy for oil to flow into a well bore and up to the surface naturally. With time, however, as reservoir energy decreases, wells are fitted with pumps to lift oil to the surface. Typically, the rate of withdrawal of oil declines as reservoir energy is reduced (Figure 2). At some point, the wells in a reservoir will not produce enough oil to offset the expenses required to keep them producing. At this point, the reservoir may be considered to be depleted, but is it? Such a reservoir may still contain 80% or more of the original oil in place! Considerable effort has been applied to develop technology to extract this residual oil. Artificially increasing reservoir energy and oil mobility by injection of water, natural gas or carbon dioxide are common methods of **enhanced oil recovery** (EOR). Most of New Mexico's known oil reservoirs are considered to be mature and many wells are able to produce oil as a result of EOR methods.

What does an oil well cost?

The cost of drilling and equipping an oil well varies with reservoir depth, pressure, temperature, rock types encountered, difficulties in drilling and the time and money spent to solve or prevent those difficulties, specialized personnel and equipment required, and many other factors. In general, individual oil well costs in New Mexico range from a low of about $150,000 to more than $1 million. Total well costs include both drilling and completion costs (Table 2). Drilling costs end when drilling ceases and all of the tests of the uncased well bore are completed. Generally at that point, test results will be interpreted to determine if the well will produce in sufficient quantity to warrant further work, or should be permanently plugged. Completion costs include cementing steel pipe called **casing** into the well bore, any **stimulation** methods that might be required to make the oil move readily into the casing (like treating the reservoir with chemicals to improve oil flow), and all of the subsurface and surface equipment necessary to move the oil from the casing to the storage tank nearby (Figure 3). Think about how an oil company would pay for an expensive oil well. Would they borrow the money, or pay for the well out of their cash or savings? It takes time to recoup the costs of drilling and completing a well, and until the well reaches **pay out**, no profit is being made on the investment.

Once an oil well is completed and begins to produce oil to the tanks, the costs of the operation do not stop. **Lease operating expenses** include costs of electricity, treating chemicals, fuels and lubricants to run pumping equipment, environmental compliance, and payroll for employees who test, gauge, and monitor production. Accounting costs involved in making sure the proceeds of the sale of the oil go to the right beneficiary, and further engineering and geological study, are charged against the well as monthly **overhead**. Also, as wear and tear takes its toll, equipment must be repaired and replaced. Overall, producing oil is a time and money consuming venture with poor profit potential in "bust" times. The challenge to the oil producers is to make the most of all economic conditions with which they may be faced.

Now that is a big paycheck!

Did you know that a drilling rig works continuously 24 hours a day, 7 days a week, 364 days a year (most suspend operations for Christmas day)

Drilling and Completion Costs

Item	Dollars
Permitting, compliance, and site construction	$4,800
Drilling rig, equipment and crew	$49,000
Fuel, lubricants, water, chemicals	$1,500
Tests and measurements w/ personnel	$17,000
Steel casing, cement and crew	$42,800
Production equipment	$35,000
Well stimulation	$20,000
Supervision and labor	$4,800
Total	$184,900

TABLE 2—Approximate costs to drill and complete the hypothetical 3500 foot deep well in Figure 2.

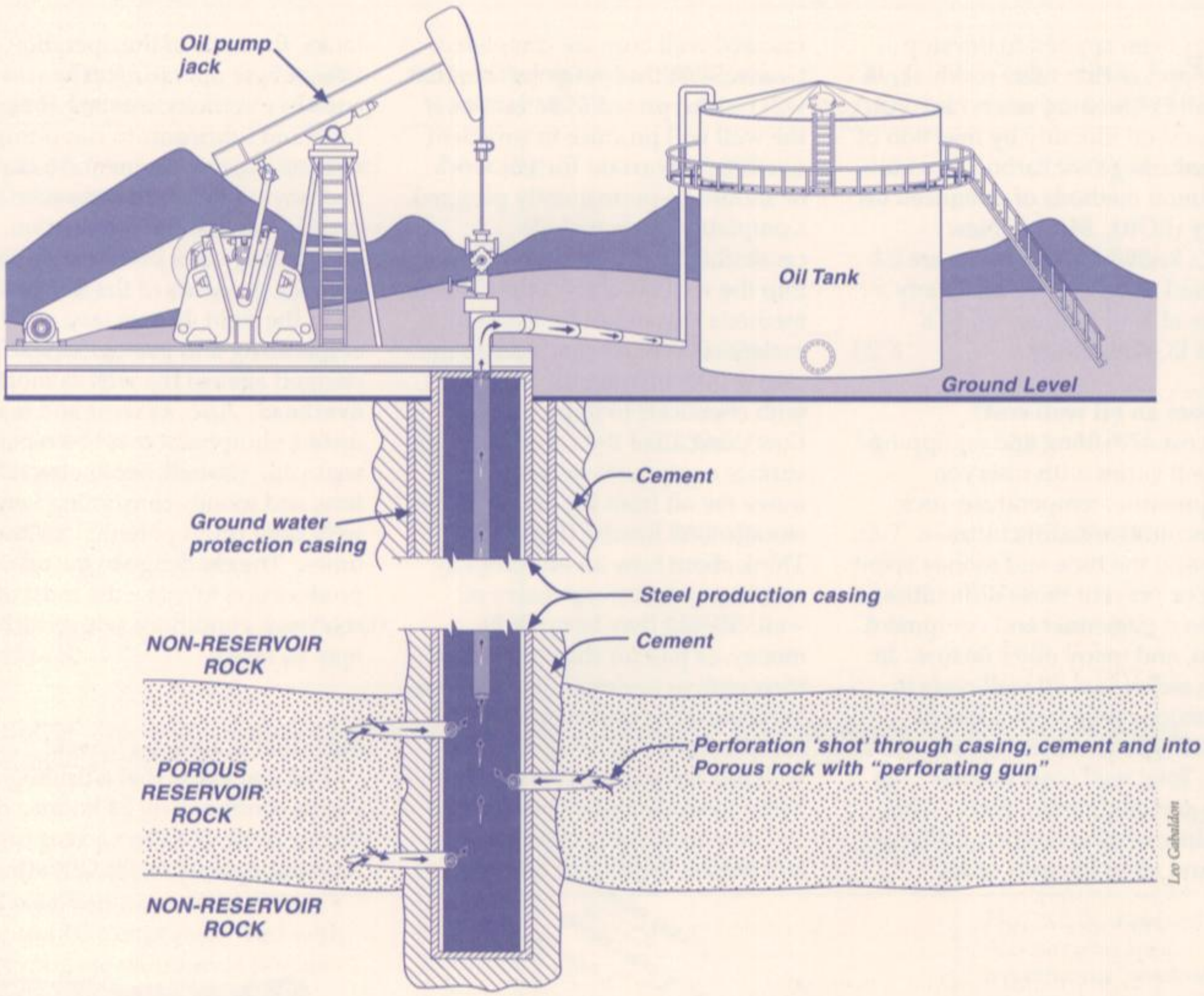


FIGURE 3 —Schematic diagram of pumping oil well and wellsite storage tank.

and on average, at any given time there are six people working at the drill site? There are many people involved in the process of planning, drilling, and producing just one oil well (Table 3). During the course of drilling an oil well, more than thirty different people have set foot on the drill pad. All of these people are highly trained and paid well to perform their own unique jobs safely and efficiently. Anyone living in an oil town like Artesia or Hobbs can appreciate that the oil business delivers good paychecks to local workers in comparison to other jobs.

In December 1998, total oil and gas industry employment for workers living in the state was 9,400 according to the New Mexico Energy, Minerals and Natural Resources Department (NMEMNRD). Of course many jobs are highly specialized and require workers to travel frequently away from home (some from out-of-state) but those people must buy fuel, and eat and sleep somewhere. Dollars are brought in from across state lines and boost New Mexico's economy. Add in taxes (payroll, sales and etc.)

Personnel Involved in Various Stages of Drilling for, and Producing Crude Oil

Planning

- ***Exploration Manager*** (a.k.a. "oil finder")
- ***Geoscientists*** (e.g. geologist, geophysicist)
- ***Engineers***
- ***Geology and engineering technicians*** (a.k.a. "geotechs")
- ***Land leasing specialists***
- ***Government regulatory personnel*** (State and/or Federal)

Drilling and Completion

- ***Operator's personnel or consultants*** (Drilling and completion engineer, well site geologist, well log analyst)
- ***Drilling contractor personnel*** (Three crews of four "roughnecks" on rotating shifts and a supervisor known as a "toolpusher")
- ***Well testing personnel*** (Pressure testing, drilling mud testing, rock sample testing, well logging)
- ***Equipment suppliers and tool specialists*** (From drill bit salesmen to portapotty pumpers)
- ***Completion service company engineers and technicians***
- ***General laborers*** ("Roustabouts")
- ***Casing crews*** (Group of four or five who specialize in lowering production casing into the well)
- ***Governmental regulatory personnel***

Production

- ***Production manager***
- ***Production engineer, geologist***
- ***Accountants***
- ***Pumpers*** (Gauging tanks and servicing equipment)
- ***Roustabouts***
- ***Governmental regulatory personnel***

TABLE 3—This table lists some of the people involved in planning, drilling, completing and producing an oil well. This list includes only upstream personnel and does not include those involved in gathering and transporting the oil, refining it, or distributing the products.

and it is clear that drilling and production activity is very good for the economy and people of the State of New Mexico. Drilling and production activity pays a big check to the state that we all share.

Who gets a piece of the pie?

We have discussed what produced oil is worth and the costs involved in getting it to the tanks. Who shares in the wealth (Figure 4)? Basically, the pie is sliced up into three main categories: **royalty interests, production taxes,** and **working interests**.

Royalty interests (primarily mineral rights owners) are paid free and clear of any well costs and operating expenses. Royalty owners in New Mexico may be the U.S. Government (50% of earnings is shared with the State), the State of New Mexico, Indian tribes, or private individuals and corporations. Of course, private royalty owners pay income taxes (state and federal) on the income they receive. New Mexico's share of state and federal owned royalties alone in 1998 was more than $255 million, including both oil and gas production (NMEMNRD).

Production taxes include state **severance, school**, and **conservation** taxes, and local municipal **ad valorem** taxes (see Figure 4). Severance taxes go into the state's Severance Tax Permanent Fund, the investment interest from which helps to support public schools as does the money for the Emergency School Tax Fund. In 1998, New Mexico's share of production taxes (excluding ad valorem taxes) was worth $315 million, including both oil and gas production (NMEMNRD).

Working interest owners are those companies and individuals who risked money in the venture. From their share of the pie, they must pay **lease operating expenses** and **overhead** (including payroll to employees) to operate and maintain the well. Working interest owners also pay state and federal income taxes on their income from oil sales; typically exceeding half of income remaining after lease operating and overhead expenses have been paid. New Mexico's 1998 income from gross receipts taxes (both oil and gas production) related to expenses and sales, but excluding payroll income taxes, totalled $18 million (NMEMNRD). Part of the income after taxes that working interest owners earn is often used to pay back the cost of drilling and completing the well, or is spent drilling additional wells. Surprisingly, the piece of the pie that represents oil company after-tax income is small compared to the rest of the pie, which in this example, largely benefits the public.

Who "gets rich"?

A significant portion of the income from oil production in the State of New Mexico helps to finance our State and Federal government and the benefits we receive from them. Drilling and production are expensive activities that pump significant cash into the New Mexico economy. New Mexico oil companies are businesses attempting to make a profit while competing in an international market; they take all of the risks, but rarely see the profits suggested by popular myths. So, who actually "gets rich" when an oil well is drilled in New Mexico? We all do!

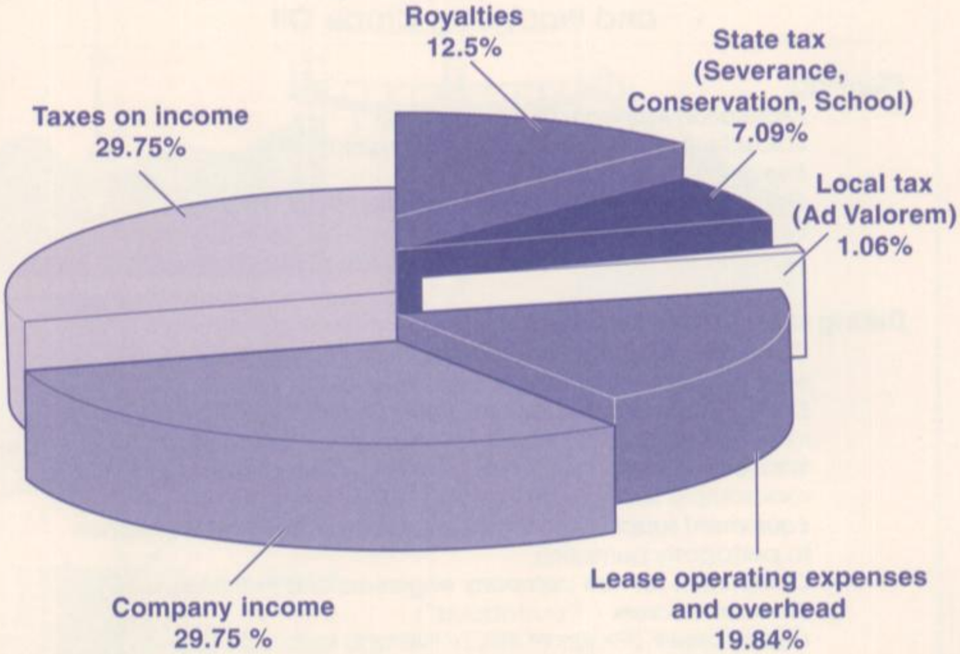


FIGURE 4—Pie chart showing an example of who benefits from a model well on leased U.S. minerals (example is from Eddy County near Artesia). Size of the slices can vary significantly from the example shown.

Mars, here I come!

Suggested Resources

Brister, B. S., 1999, Have you ever wondered…What geologists learn from drilling wells?: Lite Geology, New Mexico Bureau of Mines and Mineral Resources, no. 22, pp. 2–7.

Broadhead, R. F., 1993, Have you ever wondered...Why New Mexico is so rich in oil and gas?: Lite Geology, New Mexico Bureau of Mines and Mineral Resources, Winter 1993, pp. 2–4.

Chapin, C. E., 1999, Have you ever wondered…How much money does New Mexico receive from mining and oil and gas production?: Lite Geology, New Mexico Bureau of Mines and Mineral Resources, no. 21, pp. 3–9.

New Mexico Energy, Minerals, and Natural Resources Department (NMEMNRD; Santa Fe, NM, 505–827–5970), publishes annual reports of data and statistics of New Mexico Resources.

New Mexico Oil and Gas Engineering Committee, Inc., (Hobbs, New Mexico) publishes reports of New Mexico oil and gas production.

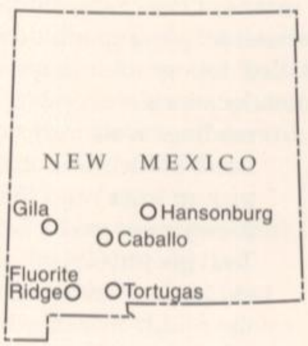
Statistics for New Mexico oil and gas production are available on-line from the New Mexico Oil Conservation Division at: http://www.emnrd.state.nm.us/ocd/, or from http://octane.nmt.edu/Start.asp.

Statistics for United States oil and gas production are available on-line from the American Petroleum Institute (which includes teachers' resources) at: http://www.api.org.

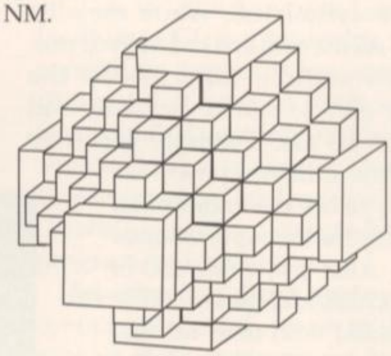
Wheeler, R. R., and Whited, M., 1985, Oil—From prospect to pipeline: Gulf Publishing Co., Houston, 147 pp.

New Mexico's Most WANTED MINERALS

Dr. V. W. Lueth, NMBMMR *Mineralogist & Curator*



Fluorite specimen with growth habit similar to diagram, from the Hansonburg district, Socorro County, NM.



A diagram of a skeletal fluorite crystal illustrating the cubic crystal habit in the construction of an octahedron.

FLUORITE

DESCRIPTION: Fluorite is usually seen as cubic crystals or crystal fragments in a variety of colors from purple to pink, green, yellow, blue, and even colorless. It is usually identified by its hardness of 4, so it can be scratched by a knife. It also has a characteristic octahedral (8-sided) cleavage so look for triangles of intersecting cleavage lines or flat surfaces. It is usually vitreous (shines like glass) and colorful. However, it is occasionally massive to granular and rarely columnar and banded. Fluorite is the root word for fluorescence, a feature displayed by the mineral's glow under ultraviolet light described in the mid 19th century by George Stokes. Fluorite gets its name from the Latin word, fluere (to flow), alluding to its low melting point.

WANTED FOR: The most common uses for fluorite are as a flux in steel making, the manufacture of opalescent glass, enameling cooking utensils, and for the preparation of hydrofluoric acid. It is also a source of fluorine used to make fluoride toothpaste. In the past, it was used as an ornamental material and for carved dishes and vases. It was also used as a fake gemstone.

HIDEOUT: Fluorite is found in hydrothermal (hot water) ore deposits as veins or large masses replacing limestone where it is fairly common. It is associated with many other minerals such as calcite, dolomite, gypsum, celestine, barite, quartz, galena, and sphalerite.

LAST SEEN AT LARGE: Fluorite is relatively common in New Mexico. It is one of the most sought after minerals by collectors because of its variety of forms and colors. Famous collecting localities include Hansonburg, Gila Fluorspar, Caballo Mountains, Tortugas Mountain, and Fluorite Ridge districts.

ALIASES: Also known as fluorspar.

Postcard from the field: *Geophysical training for astronauts*

Paul W. Bauer
NMBMMR Senior Field Geologist

The pair of Astronauts marched resolutely across the high plain, enjoying the exotic landscape and the distant volcanic plateau as seen through the thin, clear atmosphere. One of the space explorers, a Lt. Colonel in the US Air Force, and former test pilot, carefully carried a cylindrical, white metallic canister. As the duo arrived at their pre-surveyed station, they placed the canister on the sandy regolith and extracted an astonishingly sensitive piece of scientific equipment—a portable gravity meter designed specifically for the exploration of planets. After a few minutes of rotating knobs and reading dials, and satisfied with their reading of the gravitational field, the second astronaut, who holds a Ph.D. in aeronautical engineering, radioed their findings to Mars Base where the data were immediately processed by a small but powerful computer. Now, as they return the meter to its insulated canister, they are joined by a veteran astronaut who performed similar geophysical studies on the Moon during a previous expedition. They methodically continue the first-of-its-kind geophysical survey across the surface of the planet.

Science fiction? No. Mars exploration? Not yet. This was actually the scene in Taos, New Mexico, during the summer of 1999, when 31 astronaut candidates (25 Americans and six internationals) participated in a geological and geophysical training exercise jointly sponsored by NASA and the New Mexico Bureau of Mines and Mineral Resources.

The majestic landscapes of the Taos area have long provided textbook examples of various geologic landforms, and have also served as a backdrop for astronaut training exercises led by Dr. Bill Muehlberger of the University of Texas, going as far back as NASA's Apollo missions in the late–1960s. During the last few years, Paul Bauer and Peggy Johnson, geoscientists from the New Mexico Bureau of Mines, had been mapping the geology and investigating the water resources of the Taos valley. Their investigation indicated that faults buried beneath the valley alluvium were probably influencing the flow of ground water, and that a gravity survey might help delineate the faults. At about the same time, Dr. Patricia Dickerson, a NASA geologist, was looking for a field exercise to train astronaut candidates in planetary exploration techniques, in anticipation of the upcoming manned missions to Mars and the Moon. Together, they designed a series of gravity surveys that resulted in the production of 18 km of gravity lines and an excellent educational experience for the astronauts.

Hans Schlegel (kneeling) and Clay Anderson measure gravity under the supervision of Tony Lupo. The Taos Range is in the background.

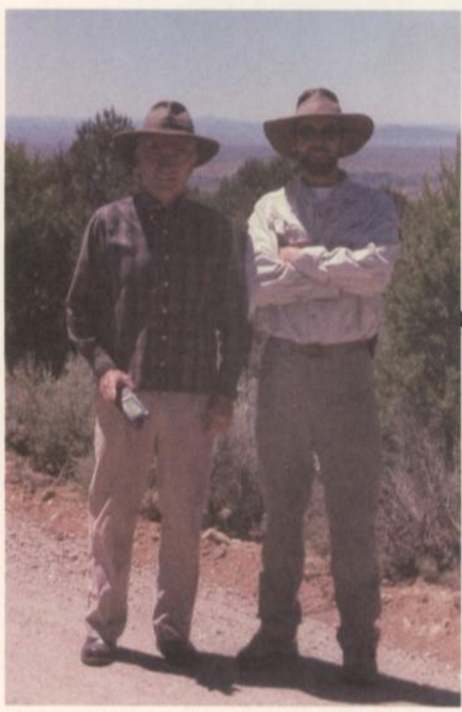
The Penguins (each astronaut class receives an animal nickname) arrived in four groups between May and July. Each field crew was briefed on the geologic setting, on the scientific objectives, and on the technique of gravimetric surveying. Then, in the field, the stations where gravity readings would be taken were located by means of laser rangefinder, newly flown aerial photographs, and detailed topographic maps. Field station locations and gravity-meter readings were radioed to "Mars Base" (which was actually a pickup truck) and the data were processed by New Mexico Tech geophysics graduate students. Each crew viewed the profile that they had acquired, participated in its interpretation, discussed how the data fit into the geologic model, and helped select the location for the next traverse.

A high point for the local participants was the surprise visit by geologist astronaut Jim Reilly and veteran astronaut and genuine American hero John Young. John Young was the first person to fly in space six times. His first flight, in 1965, was with Gus Grissom in Gemini 3, the first manned Gemini mission, where Young operated the first computer on a manned spacecraft. On his third flight, in 1969, Young was Command Module Pilot of the Apollo 10 mission that orbited the Moon. In 1972, on Apollo 16, Young collected 200 pounds of rocks from the surface of the Moon. Young's fifth flight was as Spacecraft Commander of the first flight of the Space Shuttle in 1981.

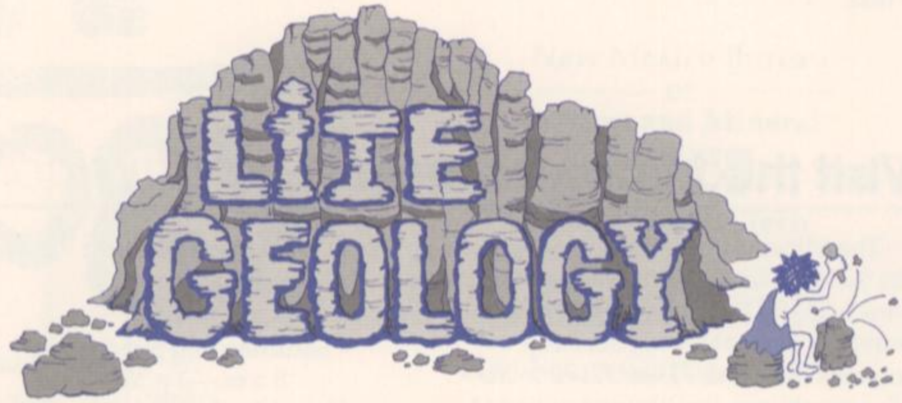
One or more of the Penguins may

step on Mars or Earth's Moon, but most will help direct those missions from Earth. All of the astronauts readily mastered the gravity technique and recognized the potential of the method for planetary exploration — particularly of Mars, where windblown sand covers a diverse geologic terrain, and astronauts will be directed to find water below the surface.

As a result of our participation in the training program, we received NASA's Lyndon B. Johnson Space Center Group Achievement Award, presented at the New Mexico Geological Society spring conference by astronaut/geologist Jim Reilly. The NMBMMR has created a "Penguin" web page at http://geoinfo.nmt.edu/penguins/ that summarizes the project.



Veteran astronaut John Young and NMBMMR geologist Paul Bauer in Taos.



Sources for Earth Science Information

The Southwest Inside Out–*An Illustrated Guide to the Land and Its History*, by Thomas Wiewandt & Maureen Wilks (Wild Horizons Publishing, Tucson) is a behind-the-scenes tour of the Greater Southwest. This stunning new book explains how the landscapes came to be formed and is written in a friendly, non-technical style with superb photographs. Teachers, southwest residents, and curious travelers will all find this book useful. Included are 37 helpful websites and annotated listings for 100 scenic attractions. To order, call the Publication Office at NMBMMR (505) 835–5410. The price is $24.95 plus shipping.

New Earth systems curricula

This fall, the American Geological Institute (AGI) is introducing two curriculum programs for secondary students that focus on Earth science from a global perspective. ***Earth System Science in the Community—Understanding Our Environment*** (***EarthComm***™) is a comprehensive program for high schools.

Investigating Earth System™ (***IES***) contains nine modules for middle schools. Both programs are designed to help students master earth-science concepts and investigative skills by integrating hands-on and web-based inquiry lessons, rather than using a supplemental laboratory booklet.

Contact Mike Smith at: msmith@agiweb.org, or visit the publisher's web site at http://www.its-about-time.com for more information. Teachers in New Mexico can contact Patty Jackson at NMBMMR, (505) 366–2533 for infomation about implementing these programs in our state.

Lite Geology

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Visit the Mineral Museum

The Mineral Museum is located in the Gold Building on the campus of New Mexico Tech in Socorro. The Bureau's mineralogical collection contains more than 13,000 specimens of minerals and rocks, along with mining artifacts and fossils.

Museum Hours:
Monday—Friday
8 a.m.—5 p.m.
Saturday and Sunday
8 a.m.—3 p.m.
Closed Institute Holidays

Contact information:

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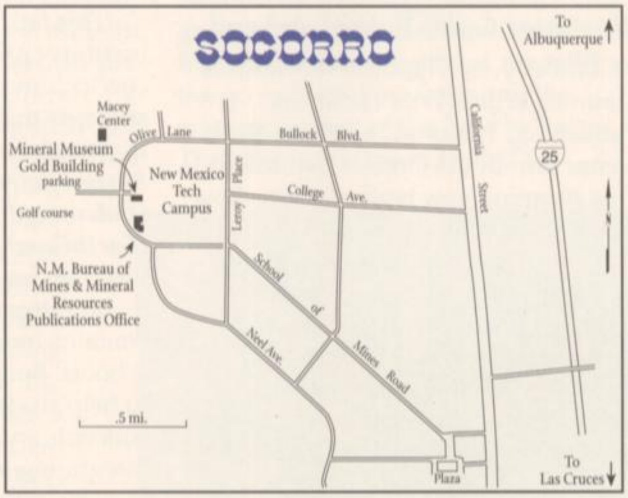

Lite Geology is published by New Mexico Bureau of Mines and Mineral Resources (Dr. Peter Scholle, *Director and State Geologist*), a division of New Mexico Tech (Dr. Daniel H. Lopez, *President*).

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.

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