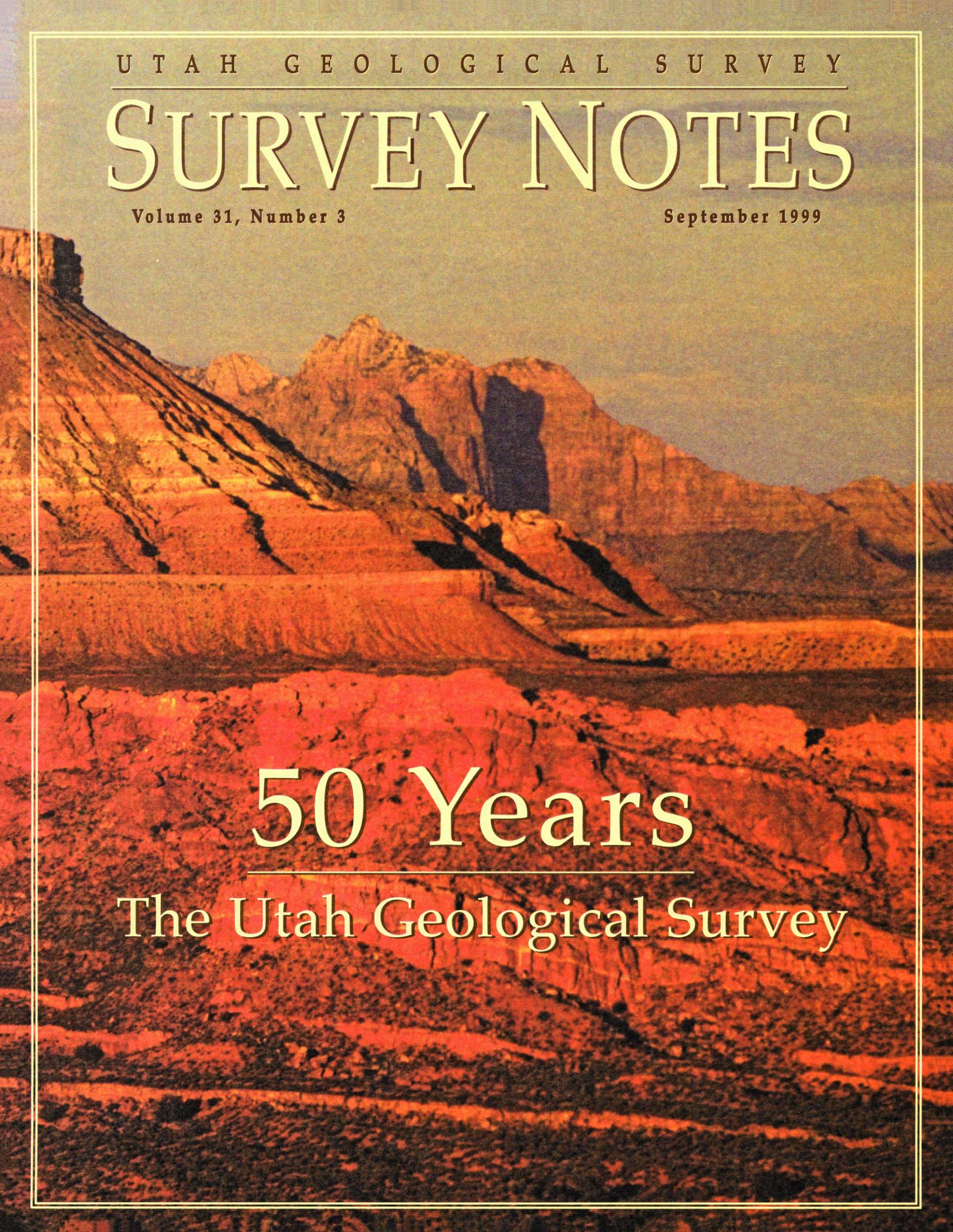


U T A H G E O L O G I C A L S U R V E Y

SURVEY NOTES

Volume 31, Number 3

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50 Years

The Utah Geological Survey

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Design by Vicky Clarke

Cover: View east to Hurricane Mesa, with Zion National Park in the distance, Washington County, Utah. Photo by Bob Biek.

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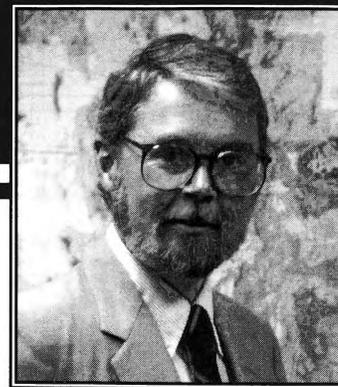
Environmental Sciences Michael Lowe

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A Farewell to Lee's Decade



After 10 years with the Utah Geological Survey, Director M. Lee Allison resigned and assumed new duties as Director of the Kansas Geological Survey in July 1999. In a farewell address at a Utah Geological Association luncheon, Lee left his colleagues with thoughts of the challenges and opportunities that the UGS and Utah will face in the next 50 years.

Lee cautioned that Utah will be a much riskier place to live as population growth along the Wasatch Front will mean more development in geologically unstable areas. He predicted the problems will not be dealt with comprehensively until or unless there is major economic or life loss. Barring that, the scale of the problem may not be fully recognized until after most development in hazardous locations is already complete, 20-30 years from now.

Lee also had words of warning for the future of geologic resources development in Utah noting that, with two-thirds of the state already under the jurisdiction of federal agencies, combined with demands for more wilderness designations, we will see more and tighter restrictions on resource exploration and development. Specifically, he predicted that Utah will cease to be a major coal producer in as little as 30 years. And while oil production will continue a long-term decline, a bright spot in the next 30 years will be natural gas production due to Utah's tight gas sands and coalbed methane.

While mineral extraction will become a minor operation in the state, industrial

minerals production should continue to be strong. Except for industrial minerals, Utah will change from a resource-producing state to a resource-consuming state.

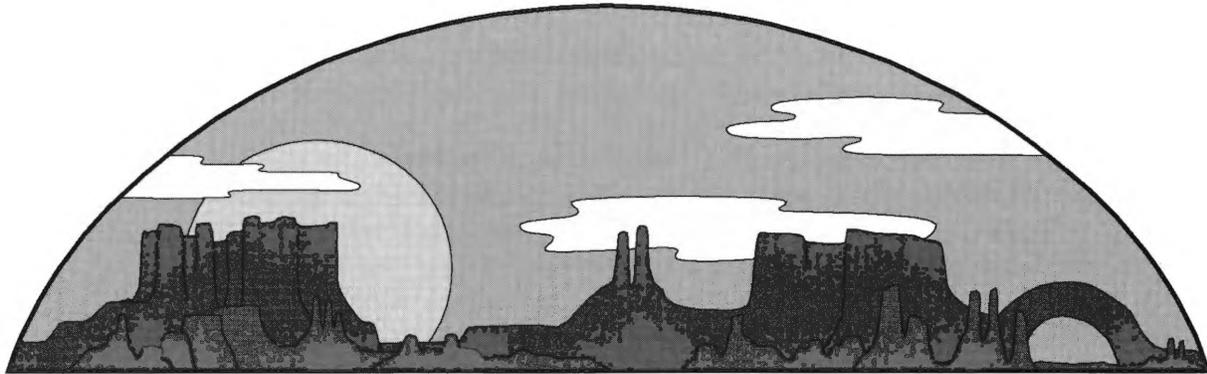
Lee attributed much of the state's past economic growth to its geology, particularly in resources and tourism. While mining will become a small part of Utah's economy in the next 50 years, tourism will increase. The geology of Utah and its parks attract millions of tourists. Dinosaur tourism could be greatly enhanced by constructing and promoting world-class museums and other destination venues. On another positive note, Lee predicted that geology will become increasingly important as the foundation of understanding ecosystems and long-term global change.

Lee concluded his address with what roles the UGS could have in the next 50 years: partner with industry to extend the life of existing resources (such as applying secondary and tertiary recovery techniques for oil) and find new and alternative sources of energy and minerals, bring science to land-use decisions and influence government decision-making, work with other specialists and other entities to implement loss-reduction strategies and reduce risks from geologic hazards, and enhance tourism.



Lee receives Honorary Lifetime Membership status in the Utah Geological Association in recognition of dedicated and meritorious services.

Survey Notes is published three times yearly by Utah Geological Survey, 1594 W. North Temple, Suite 3110, Salt Lake City, Utah 84116; (801) 537-3300. The UGS inventories the geologic resources of the state, identifies its geologic hazards, disseminates information concerning Utah's geology, and advises policymakers on geologic issues. The UGS is a division of the Department of Natural Resources. Single copies of *Survey Notes* are distributed free of charge to residents within the United States and Canada and reproduction is encouraged with recognition of source.



UTAH GEOLOGICAL SURVEY

A Brief History

This year marks the 50th anniversary of the Utah Geological Survey. Throughout its existence, the UGS has promoted a better understanding of Utah's geology through topical research, geologic mapping, and dissemination of information to the public, industry, educators, and policy makers. Growing from a small organization affiliated with the University of Utah and operating under a biennial budget of \$25,000, the Survey now comprises five distinct geologic programs, each one exploring different aspects of Utah's geology, and has an annual budget of about \$4 million.

To celebrate this growth and to mark our 50th year, the following summary highlights some of the important events in the UGS' history.

Year

Event

1919

University of Utah Board of Regents establishes the forbearer of the UGS, the "University Geological and Resource Survey of Utah," under the direction of Dr. Frederick J. Pack. No funding is provided.

1929

Bill introduced to state legislature to formally create the "Utah Geological and Mineralogical Survey." The bill fails.

1931

Utah Geological and Mineralogical Survey (UGMS) created by the Utah State Legislature. Governor appoints an advisory board, but no funding is appropriated for salaries or operations and no personnel are assigned to the Survey.

1941

The UGMS and various other state agencies, including the Utah State Parks Commission, are placed in the newly created "Utah State Department of Publicity and Industrial Development" (UPID). The UPID hires geologist A.M. Buranek. Over the next few years, Buranek and other contract personnel publish 36 geologic publications sponsored by the UPID.

- 1946 Arthur L. Crawford appointed by Governor Maw as commissioner of the UPID. Governor Maw urges Crawford to activate the UGMS. Crawford re-hires Buranek and adds geologists M.M. Bell and Dr. George Hanson of Brigham Young University, but work continues under the auspices of the UPID.
- 1949 Birth of the "modern" UGMS. UPID disbanded by the state. UGMS transferred to the State School of Mines and Mineral Industries at the University of Utah. Crawford appointed first Director of the UGMS and Legislature appropriates \$25,000 for 1949-1951 biennial budget.
- 1951 UGMS Sample Library established in cooperation with geology departments of the state's universities, the Utah Geological Society, and the Intermountain Association of Petroleum Geologists. Support provided by grants from the University of Utah research fund.
- 1961 Crawford retires, UGMS advisory board names Dr. William P. Hewitt director. Focus shifts from general research to economic geology studies.
- 1961-65 UGMS and University of Utah College of Mines and Mineral Industries jointly publish the four-part, 1:250,000-scale geologic map of Utah.
- 1963 Utah Governor Clyde appropriates a part of the state's mineral-lease revenues to the UGMS.
- 1964 The first issue of the quarterly publication Quarterly Review (renamed Survey Notes in 1976) is published, containing information pertaining to Utah's geology and mineral industry.
- 1966 The Survey creates the Economic Geology Program under the direction of Dr. Hellmut Doelling.
- 1970 UGMS receives its first outside grant to study Utah coal deposits under the direction of Dr. Hellmut Doelling.
- 1973 Legislature transfers UGMS from the University of Utah to the Utah Department of Natural Resources; name shortened to "Utah Geological and Mineral Survey" (previously "Mineralogical"). UGMS Advisory Board replaced by a seven-member Board appointed by the Governor. Legislature officially names the Survey Director as State Geologist.
- 1974 Hewitt retires and is succeeded by industry mining geologist Donald T. McMillan.
- 1976 UGMS moves its headquarters from the University of Utah main campus to Research Park.
- 1977 The Legislature charges the Survey with responsibility for assessing earthquake risks throughout the state.
- 1981 Survey staff grows to 20 full-time and nine part-time geologists and 10 support staff. McMillan retires; Genevieve Atwood, the Survey's and the nation's first woman State Geologist, is appointed Director. Focus shifts to geologic mapping and geologic hazards.

- 1983 Establishment of the Geologic Mapping Program.
- 1984 Addition of the Geologic Mapping and Applied Geology Programs in recent years aids the Survey's growth to 26 full-time geologists, 10 geotechnicians, and 17 support staff.
- 1985 The Wasatch Front County Hazards Geologist Program is initiated with funding from the USGS National Earthquake Hazards Reduction Program (NEHRP). Three geologists are placed in five counties, Weber-Davis, Salt Lake, and Utah-Juab, to aid local governments in reducing geologic hazards.
- 1987 UGMS initiates the Mineral Lease Special Projects program using mineral-lease money to engage outside expertise to pursue specific geologic information in areas of the state not investigated by UGMS staff.
- 1989 Genevieve Atwood steps down, Dr. M. Lee Allison named UGMS Director. Focus shifts to economic geology (petroleum) and information dissemination.
- 1991 UGMS shortens name to "Utah Geological Survey" (UGS), moves its headquarters to Foothill Drive.
- 1992 Dr. Lehi F. Hintze is awarded the 1992 Governor's Medal for Science and Technology.
- 1993 Dr. Hellmut H. Doelling is awarded the 1993 Governor's Medal for Science and Technology.
- 1994 Water Section established in Applied Geology Program.
- 1995 Four staff, including the State Paleontologist, of the Antiquities Section (Paleontology/Paleoecology) of the Utah Division of State History are transferred to the UGS. Paleontology Certification Program receives one-time funding from Legislature. The Geologic Extension Service is created.
- 1996 UGS moves to new Department of Natural Resources complex. UGS opens its first regional office on the campus of Southern Utah University in Cedar City in response to southwestern Utah's population and construction boom. UGS Sample Library Trust Fund established. Environmental Sciences Program created, combining Water Section in Applied Geology and Paleontology and Paleoecology.
- 1997 UGS given the Western States Seismic Policy Council (WSSPC) 1997 Award in Excellence in the category of Outreach to the General Public for its strategy of increasing earthquake awareness in Utah.
- 1998 Dr. David B. Madsen, internationally recognized authority on the archeology and paleoecology of Utah and the western United States, is awarded the 1998 Governor's Medal for Science and Technology. A new 14,000-square foot sample library is constructed at the Department of Natural Resources complex.
- 1999 Full- and part-time UGS staff includes 37 geologists, 10 geotechnicians, and 20 support staff.

Historical Events Related to the Geology of Utah

Utah is known for the spectacular exposure of its geologic features and the diversity of its mineral resources and geologic hazards. Most of Utah's many state and national parks, monuments, and recreation areas showcase the variety and scenic beauty of Utah's landscapes and geology. Some of Utah's unique geologic features include Great Salt Lake, the Wasatch fault, and the canyonlands area of southern Utah. Utah also has an abundance and variety of natural resources, ranking fifth in the nation in total value of nonfuel minerals; first in the production of beryllium and gilsonite; second in copper, gold, magnesium metal, and potash; fifth in silver; sixth in salt; and fourteenth in coal (1997 rankings, the latest year for which production figures are available). Unfortunately, Utah is also known for its geologic hazards. The Wasatch fault is one of the longest active normal faults in the world, and Utah is among eight states that the U.S. Geological Survey has given a landslide hazard rating of "severe," the highest of five hazard classes.

The geology of Utah has provided an important backdrop to the cultural history of the area for as long as people have lived in this region. As the Utah Geological Survey celebrates its 50th anniversary, it seems appropriate to highlight some of the important people and events related to the geology of Utah.

Year	Event
prehistoric	Native Americans utilize many geologic resources, such as salt from Great Salt Lake for cooking; stone for construction, tools, and weapons; clay for pottery; and minerals for colored pigments and ornaments.
1776	During the Dominguez-Escalante expedition, detailed notes and drawings are created that include the first observations on Utah geology.
1843-44	The first geologic specimens (rock and mineral samples) from Utah for scientific investigation are collected by John C. Fremont during the second of his five western expeditions.
1845	John C. Fremont's report of his 1842 and 1843-44 expeditions is the first scientific publication to include information on Utah's geology.
1847	Almost from the day they enter the Salt Lake Valley, early Mormon settlers obtain salt by boiling water from Great Salt Lake in iron kettles.
1849	While exploring for colonizing sites and available resources south of Salt Lake Valley, Parley P. Pratt and his men discover iron ore at Iron Mountain near present-day Cedar City in Iron County.
1849-50	While leading one of the earliest railroad surveys of the West, Captain Howard Stansbury makes

- the first detailed descriptions of Utah geology (of the Wasatch Range and the Great Salt Lake Desert) and the first scientific report of an earthquake in Utah.
- 1855 Jules Marcou publishes the first geologic map of Utah as part of a geologic map of the United States in an obscure German journal.
- 1858 Utah's first reported gold discovery is at Gold Hill in Tooele County by westbound travelers on their way to California.
- 1859 Utah's first dinosaur discovery, and North America's first sauropod find, is made during the 1859 Macomb Expedition which explored the rugged canyon lands of southeastern Utah. The expedition's scientist Dr. John S. Newberry collected bones from a sauropod dinosaur subsequently named *Dystrophaeus viaemalae*.
- 1863 General Patrick E. Connor and others formally organize Utah's first mining district, West Mountain (Bingham), after the discovery of lead-silver ore in Bingham Canyon in the Oquirrh Mountains of Salt Lake County.
- 1866 Gilsonite, originally called uintahite and discovered in Utah, is first announced to the scientific world. It has been mined since the 1880s and is shipped worldwide. Gilsonite is a solid hydrocarbon that is resistant to acids and moisture and is used as a base or component in various paints, anti-corrosive coatings, insulating and waterproofing jackets for underground pipes, and automotive body sealers.
- 1874 The Silver Reef (Harrisburg) mining district is organized by John Kemple, who first discovered silver in sandstones of the area in 1866 or 1869.
- 1877 Inferior deposits of coal had been found in Utah during the 1850s and 60s, but now mining begins at Utah's first major coal development, the Wasatch Plateau coalfield at Winter Quarters in Carbon County. This coal quickly becomes fuel for the stoves and furnaces of the Wasatch Front.
- 1890 Lake Bonneville, U.S. Geological Survey Monograph 1 by G.K. Gilbert, is published. Gilbert, one of America's greatest geomorphologists, was the first to study and describe the prehistoric lake features of Lake Bonneville.
- 1891 Discovery of natural gas in the Farmington Bay area on the east shore of Great Salt Lake marks the beginning of Utah's natural gas industry.
- 1901 One of the largest historical earthquakes in Utah is the Richfield earthquake with an estimated magnitude of 6.5.
- 1906 The Bingham Canyon mine becomes the world's first open-pit copper mine and starts the porphyry copper mining business worldwide. Today it is the largest excavation on earth with 250,000 tons of rock being extracted every day.
- 1907 The Virgin oil field in Washington County becomes Utah's first oil-producing field (although not in commercial quantities because of its small production).
- 1909 Paleontologist Earl Douglass discovers thousands of dinosaur bones, including several nearly complete skeletons, at the current site of Dinosaur National Monument.
- 1915 Dinosaur National Monument near Vernal is created. It contains the largest concentration of Jurassic Period dinosaur bones ever discovered and is a unique natural exhibit with more than 1,600 dinosaur bones that were deposited in an ancient river bed.
- 1919 Utah's first national park, Zion National Park, is established to preserve and protect its scenic beauty and unique geologic features.
- 1923 Debris flows, triggered during a cloudburst rainstorm, emanate from canyons in the Farmington area of Davis County causing the most disastrous flood in Utah's history, killing seven people and

- damaging homes, roads, irrigation canals, crops, water systems, railroad tracks, and telephone lines.
- 1930 Major debris flows and floods in Davis County kill more than 2,000 farm animals (mostly chickens) and damage or destroy crops, structures, automobiles, roads, railroad tracks, farmland, and irrigation systems.
- 1934 The largest historical Utah earthquake is the magnitude 6.6 Hansel Valley earthquake in northwestern Utah, which produces surface fault ruptures along a zone 5 miles long with up to 20 inches of vertical displacement. In downtown Salt Lake City, two adjacent tall buildings sway sufficiently to make contact. This earthquake influences further development of seismographic instrumentation within Utah and stimulates local attention to earthquake-related problems.
- 1942-44 To meet increased war demands for steel, the Geneva steel plant, one of the largest producers of steel in the West, is constructed. This has a major impact on the mining of Utah iron ore, coal, and limestone and dolomite.
- 1948 A natural gas well in Ashley Valley field, near Vernal in the Uinta Basin, is deepened to become Utah's first oil well to produce petroleum in commercial quantities.
- 1952 Charlie Steen's discovery of pure uraninite ore near Moab brings about the uranium boom of the Colorado Plateau.
- 1959 A rock-filled causeway across Great Salt Lake is built for the railroad. The causeway restricts circulation of water between the north and south arms of Great Salt Lake, creating a higher water level to the south and saltier water to the north.
- 1961-65 Utah Geological and Mineralogical Survey and University of Utah College of Mines and Mineral Industries jointly publish the first detailed geologic map specifically of Utah in four parts at a scale of 1:250,000.
- 1962 An extremely damaging magnitude 5.7 earthquake occurs near Richmond in Cache Valley. Over three-fourths of the houses in Richmond are damaged, the Benson Stake Tabernacle has to be demolished, and mudslides and rockfalls close highways and canals.
- 1963 Great Salt Lake water level drops to its lowest historical elevation of 4,191.35 feet above sea level.
- 1966 Recognized worldwide as the primary source for skeletons of the flesh-eating Allosaur, the Cleveland-Lloyd Dinosaur Quarry is designated a National Natural Landmark. Over the years, bones have been taken from the quarry representing at least 70 different animals and 14 species. Casts and original skeletons assembled from these bones are on display in over 60 museums worldwide.
- 1969 Production of the only developed source of beryllium (bertrandite) ores in North America begins at Spor Mountain, Juab County. Beryllium is a rare, light-weight, high-strength, heat-resistant metal that is used in a variety of high-tech products and applications including aerospace vehicles such as the space shuttle, and computer and telecommunication equipment.
- Topaz becomes Utah's official state gem. Topaz is found in cavities in the rhyolites of the Thomas Range of western Utah and occurs as very hard, transparent crystals in a variety of colors.
- 1970 Operations begin to mine potash underground from the Cane Creek mine near Moab. Accidental flooding forces conversion of the mine to a subsurface solution mine. Water is injected at one end and then pumped out 300 days later at the other end. This water, saturated with soluble potash and salts, is pumped into shallow evaporation ponds where the dried potash is eventually removed by earthmoving equipment.
- 1972 A magnesium plant (currently named MagCorp) begins operations to utilize magnesium chloride brines from Great Salt Lake for the production of magnesium metal and chlorine gas.

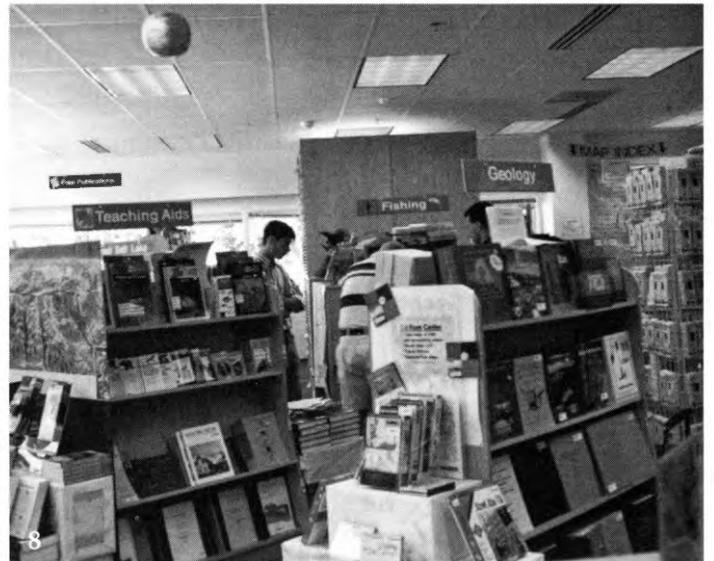
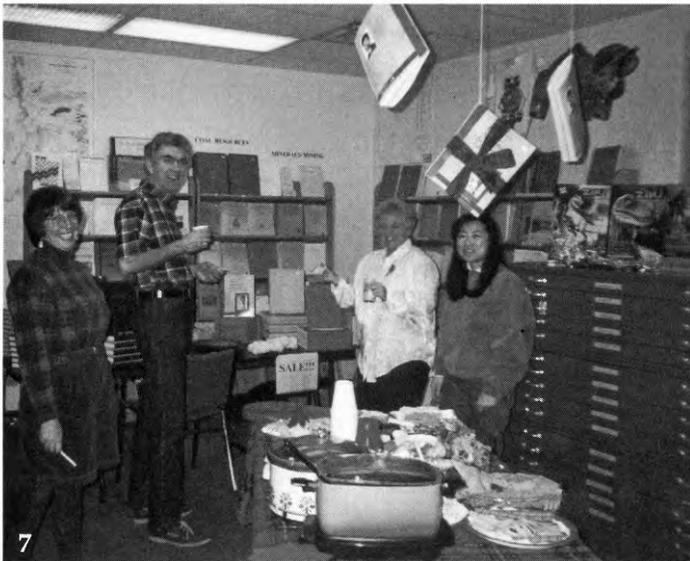
- 1975 Discovery of the Pineview oil field in Summit County sparks new interest in overthrust belt investigations that ultimately lead to the discovery of prolific oil and gas fields in northeastern Utah.
- Geothermal resources in the Newcastle area, located on the southeastern edge of the Escalante Valley, are discovered. Commercial greenhouse complexes take advantage of the geothermal system for space heating and produce tropical plants and hydroponic vegetables for markets in the western United States.
- 1983 Extensive flooding and landsliding due to rapid snowmelt, combined with above-average precipitation over several years, results in damage so extreme that 22 of Utah's 29 counties are declared eligible for national disaster assistance. In Salt Lake City, streams are diverted onto streets to handle the excess flow. The most damaging and costliest landslide is the Thistle landslide in Spanish Fork Canyon, Utah County, which dams the Spanish Fork River, cutting off major east-west rail and highway corridors, inundating the town of Thistle, and costing over \$250 million.
- The Mercur mining district, located in the southern Oquirrh Mountains, is revitalized after being idle since 1942 when the Mercur mine began production, becoming one of the major gold producers of North America. Production from the mine ended in 1997 due to depletion of the ore reserves.
- 1984 The geothermal waters of the Roosevelt Hot Springs near Milford in Beaver County are used to generate electricity at the Blundell power plant, resulting in the first significant commercial generation of electricity from geothermal resources in the United States outside of California.
- 1985 The Apex (Dixie) mine, Tutsagubet mining district, Washington County, reopens as the world's first mine to operate primarily for the extraction of two space-age metals, gallium and germanium, which are used in light-emitting diodes, photo detectors, integrated circuits, and fiber-optic systems.
- 1986 Great Salt Lake rises to its historical high of 4,211.8 feet due to above-average precipitation over several years.
- 1988 Mining begins at the Barneys Canyon operation, which consists of at least five gold deposits located in the Oquirrh Mountains about 5 miles north of the Bingham Canyon open-pit mine. Production is expected to continue through the year 2001.
- The *Allosaurus fragilis*, the largest carnivore of the Jurassic Period, becomes Utah's official state fossil. More allosaur specimens have been found in Utah's quarries than any other dinosaur. On average, allosaurs weighed 4 tons, stood 17 feet high on two legs, and measured 35 feet long.
- 1991 A horizontally drilled oil well is successfully completed in the Moab area. Horizontal drilling is an ideal technique to recover oil trapped within fractured rock and can be used to revitalize oil fields.
- 1991 A new carnivorous dinosaur, Utahraptor, is discovered at the Gaston quarry near Moab. This is the largest (estimated at 20 feet in length) and oldest known dromaeosaurid (about 125 million years old, Early Cretaceous Period). Dromaeosaurids, popularly known as "raptors," may have hunted in packs and slashed their prey with a blade-like claw that was attached to each foot.
- Coal is officially recognized as the Utah State Rock. Coal is found in 17 of Utah's 29 counties, but coal mining is primarily concentrated in Emery and Carbon Counties.
- 1992 Ground shaking during the magnitude 5.8 St. George earthquake causes damage to buildings in St. George and nearby communities and triggers a massive, destructive landslide about 28 miles away in Springdale which destroys three homes.
- 1998 Landslides in northern Utah severely damage homes. The Thistle landslide in Spanish Fork Canyon is reactivated.

The UGS At Large

UGS Moves Around....



1. UGMS is first housed in the School of Mines and Mineral Industries on the University of Utah campus (circa 1967).
2. UGMS moves to Research Park in 1976.
3. UGS digs on Foothill Drive (1995).
4. UGS now in the Department of Natural Resources building, in which the bookstore's new name is prominently displayed.
5. Original "Sample Library" - Utah Geological Survey Library of Samples for Geologic Research on the University of Utah campus (circa 1951).
6. Current, 1999, Sample Library
7. While on Foothill Drive, the bookstore expands and becomes a retailer for USGS topographic maps.
 - Mage, Sharon, Werner, and Vicki party at the Bookstore's open house, Christmas 1995.
8. Current, 1999, bookstore
- 9-11. Staff learn how to live out of boxes. Moving woes/fun.
 - Doug makes a box wall
 - Mage wins "the most boxes moved" award.
 - Bill vacuums!?!



UGS Projects

Economic Program



1

1. Great Salt Lake Research (circa 1965) was performed with amphibious ducks and the G.K. Gilbert.
2. Surveying the south shore of the Great Salt Lake, 1965, using one of the UGS's amphibious ducks.
3. Measuring crust of Bonneville Salt Flat (date, people unknown).
4. Bob Blackett and Mike Shubat on a geothermal project, 1989
5. 1994 Emery Field Office, Ferron Sandstone project. Tom Chidsey and Roy Adams.
6. Economic geologist Steve Sommer measuring in situ permeability for the Ferron Sandstone project, 1994.
7. For the Paradox Basin project, Tom Chidsey and Craig Morgan employ a new technique to look for petroleum, rafting the San Juan River, 1995.
8. Charlie Bishop examines a pilot plant extracting asphalt from tar sand, 1994.
9. The Sample Library hosts core workshops.



2



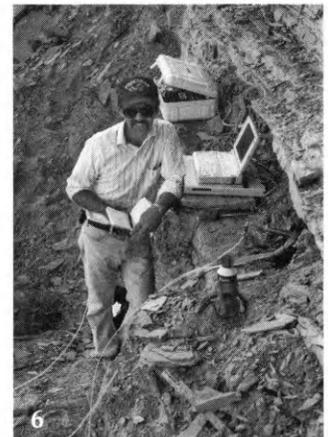
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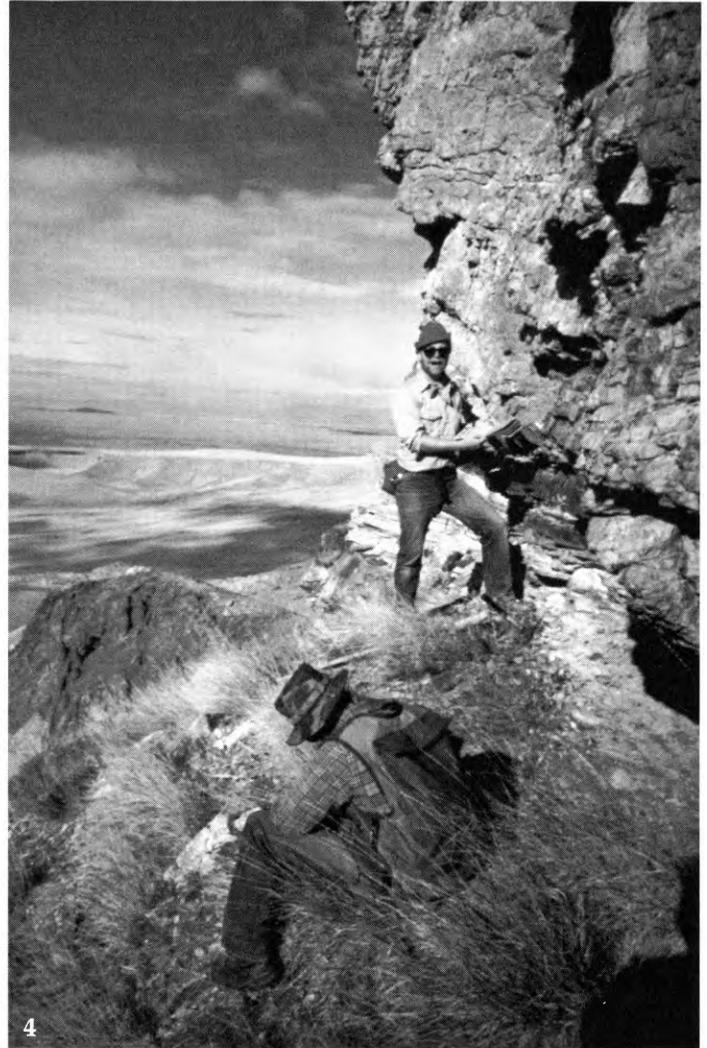
Applied Program



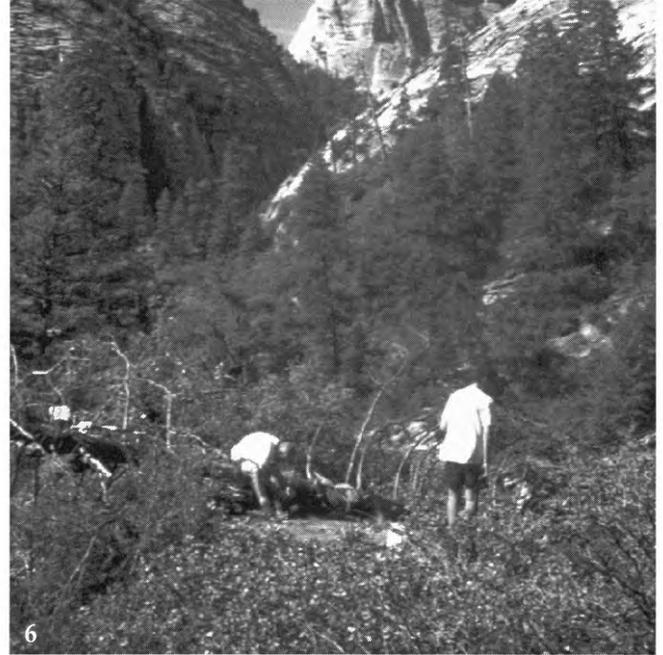
1. Genevieve Atwood mucking around Thistle landslide, April 1983.
 2. Bill Black hosts a field trip to the South Fork Dry Creek trench site along the Salt Lake City segment of the Wasatch fault for the Western States Seismic Policy Council, 1994.

3. Mike Lowe at the Springdale landslide scarp, caused by the 1992, magnitude 5.8 earthquake near St. George.
 4. Rich Giraud checks out a landslide in City Creek Canyon, 1998.

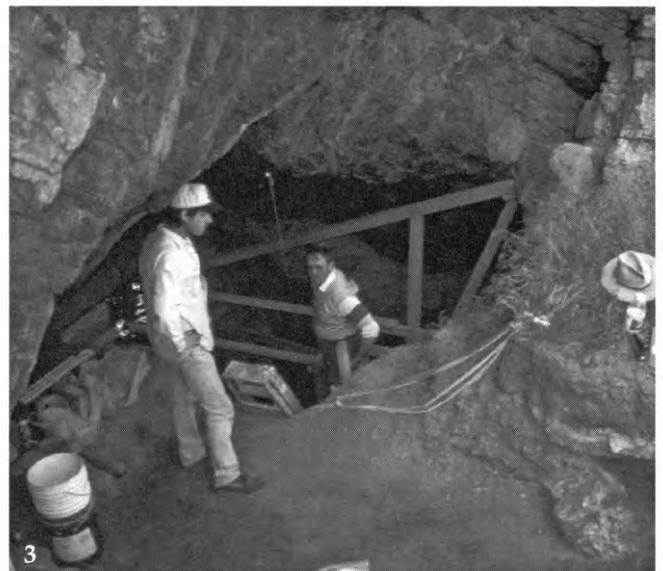
Mapping Program



1. Fitz Davis examines abandoned placer gold operation near Dolores River during Grand County mapping project about 1985.
2. Mike Hylland (left), Grant Willis (western hat), and Hellmut Doelling, UGS mappers, examine recently completed geologic map of Grand Staircase-Escalante National Monument.
3. Kent Brown (1997) loads aerial photographs into the new analytical plotter purchased in 1991. The UGS was (and still is) the only state survey to own a fully digital analytical stereoscopic plotter.
4. John Hand (standing) and Mark Jensen measure and describe Proterozoic Mineral Fork and Kelly Formations on Antelope Island during UGS comprehensive study of the island in 1987.
5. Bob Biek breaks a boulder of the Virgin basalt flow to obtain a fresh sample for radioisotopic dating during the St. George basin geologic mapping project.
6. Geologists break camp to begin the day's work during mapping of Zion National Park in 1998.

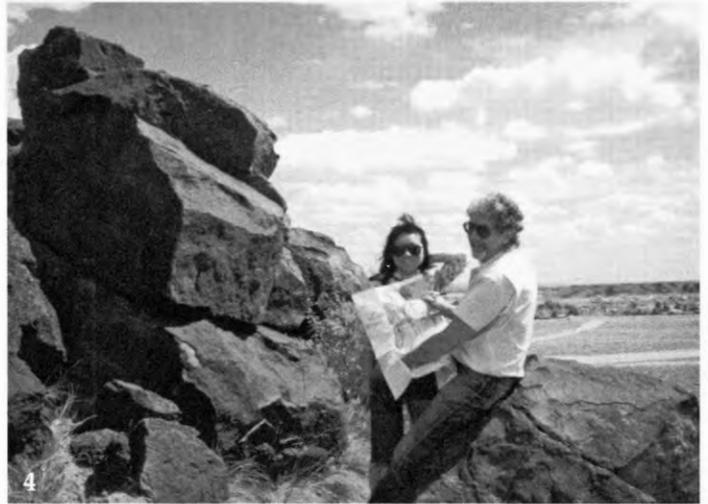


Environmental Sciences Program



1. Paleontology Section's Martha Hayden and Dave Gillette, along with Utah Friends of Paleontology volunteers move a plastic jacket containing an articulated allosaur skeleton near Ferron, 1998.
2. Paleocology Section's David Madsen and Dave Schmitt dig around Camels Back Cave, 1998.
3. Paleocology Section's Monson Shaver and Kathy Callister, archeologist from Dugway Proving Grounds, in Camels Back Cave, 1998

Geologic Extention Service Program



1. Bookstore staff Pat Stokes and Carl Ege are happy campers at the GSA conference with the new and improved UGS booth, 1997.
2. Geologist Carl Ege finds the geode sign to begin his Rockhounder mission.
3. Sandy Eldredge leads a National Science Teachers Association field trip in Arches National Park, 1994.
4. GES's Bill Case and Mage Yonetani provide educational instructions in the field.
5. Geologist Mark Milligan helps kids find gold during PreHistory week, 1999.

UGS Picnics and Parties, too.....



1



2



3



4



5

1 & 2. Rafting the Snake River, 1990.

- the UGS team still dry and anxious to go.

- Bill Mulvey, Mage, and Case go paddling.

3. Picnic at Foothill office with visiting Chinese scientist Wenzhi Zhao, 1992. Craig, Kent, Patty, Lee, and Jon.

4 & 5. At the annual summer picnics,

- as is basketball

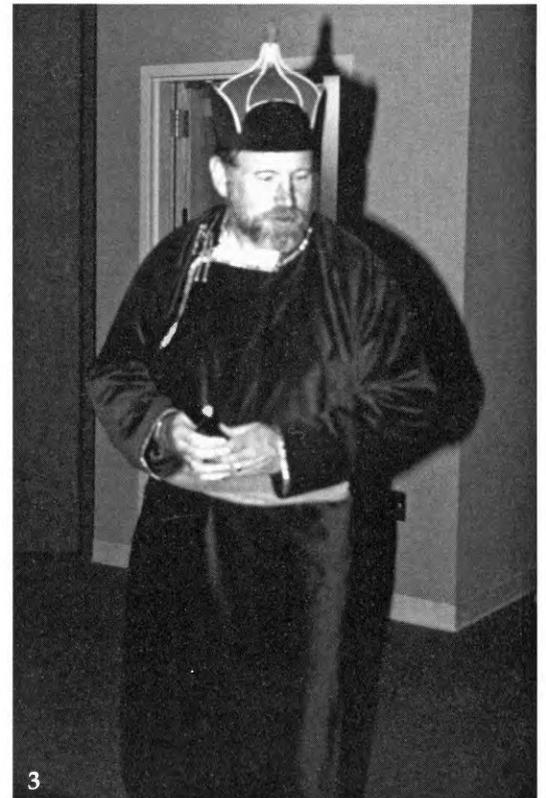
- volleyball is hot

6. UGS ski day in the parking lot. Grant, Mike Shubat, Miriam, Mike Ross.

7. Annual in-house Christmas parties - this is 1995 "open house" in editorial.



UGS has fun at work....



1. Huey, Dewey, and Louie (Craig, Lee, and Tom) do the "get ready for conference booth" dance.
2. Werner, Genevieve, Rosalyn, and Doug hear no evil, see evil, speak no evil.
3. Bill Lund tries to convince us that he actually worked in Mongolia.

Utah Geological Survey Garner Major Grant to Fund Mapping Projects

As the population of Utah grows and more demands are made on its natural resources, the need also grows for detailed information about geologic hazards, environmental concerns, and land-management issues. That means a need for better and more accessible maps.

The Utah Geological Survey, which is beginning its 50th year of service to the state, has received a grant of \$130,000 to help fund an ongoing effort to produce detailed geologic maps of areas throughout Utah. The grant came from the STATEMAP component of the National Geologic Mapping Program, administered by the U.S. Geological Survey and the Association of American State Geologists. Of 45 states submitting proposals for 1999, Utah received the third highest share of the nearly \$4 million available.

"The UGS Mapping Program has an excellent track record proven by publishing more than 155 geologic maps," noted C. William Berge, chair of the Utah State Mapping Advisory Committee. "The UGS has successfully completed all prior STATEMAP contracts and has produced top quality, accurate, reliable maps. The maps it will produce in this project are urgently needed for geologic hazard

evaluation, environment studies, resource studies, and other pressing issues."

The funded projects include:

- **Provo and Dutch John 30'x60' quadrangles.** This is a three-year effort to field-map the area of the Uinta Mountains and northeastern Utah. Currently, more than half of these quadrangles are not adequately mapped at a scale of 1:100,000, which means the existing information is not suitable for digital compilation. The Provo quadrangle includes Utah Valley, which is one of the fastest growing regions of the state, as well as the Wasatch Range, Heber Valley, Strawberry Valley, and the Uinta Mountains, which contain some of the most popular recreation areas in Utah. The Dutch John quadrangle is remote and rugged, but contains the heavily used Flaming Gorge National Recreation Area and large tracts of land that were recently proposed as wilderness. Many of these areas have not been evaluated geologically in significant detail and could contain deposits of oil, gas, coal, phosphate, and other economic resources.

- **Pintura 7.5' quadrangle.** Located in the rapidly expanding St. George Basin, this area has known geologic hazards that present a major threat to both safety and development. Local officials are trying to develop zoning ordinances that will protect property and people, but are hampered by the lack of accurate, detailed geologic maps. Under the STATEMAP project, UGS mappers will add to the information that is now being used to inventory sand and gravel resources and to identify and protect critical geologic features.

- **Wah Wah Mountains North 30'x60' quadrangle digital compilation.** This project will digitize a new map of Millard County that is currently being prepared by Lehi Hintze, geology professor emeritus at Brigham Young University. Mapping of this region has been underway for more than 40 years. Some land in this quadrangle is contained in wilderness proposals advanced by the Bureau of Land Management.

Energy News

Wider Use of Utah Coal Could Reduce Greenhouse Gases, Study Finds

Because Utah coal produces less carbon dioxide (CO₂) than other coals mined in the United States, wider use of the local product could reduce the potential for greenhouse gas emissions, a study co-authored by a UGS scientist concludes.

"Upon combustion," says Jeffrey C. Quick of the Economic Geology Program, "different coals produce different amounts of CO₂ per unit of heat made available to the boiler. Although the energy content of coals burned at electric power plants is routinely measured, the amount of carbon in these coals is not. Consequently, the amount of CO₂ emitted to the atmosphere from coal combustion must be estimated. Current methods, while adequate for national CO₂ inventories, underestimate the range of variation of CO₂ from combustion of different kinds of coal."

The study suggests that significant and immediate reduction of greenhouse gas emissions is possible by selection of relatively low-CO₂ coal for combustion and that Utah coal produces up to 10 percent less CO₂ than other western U.S. coals. Quick adds that the implications of the research extend beyond Utah and point to systematic errors in the method used by the Intergovernmental Panel on Climate Change to verify Kyoto Protocol greenhouse gas emission targets.

The study, co-authored by David C. Glick of the Coal and Organic Petrology Laboratories at The Pennsylvania State University, has been submitted for publication to *FUEL*, an international journal of fuel and energy science and technology.

UGS Petroleum Project Earns an A for Effort

A U.S. Department of Energy petroleum project by the Utah Geological Survey has earned excellent reviews in all ratings categories.

The project, "Geological and Petrophysical Characterization of the Ferron Sandstone for 3-D Simulation of a Fluvial-Deltaic Reservoir," was a competitive, \$1.67 million contract that began in 1993. The project is scheduled for completion this year. "Fluvial-deltaic reservoirs" are actually deltas created by ancient rivers, then covered over, compressed, or otherwise contorted by geologic pressures and movements over millions of years. Their geologic properties make them natural major traps for oil and gas reserves. The oil fields in Alaska, along the U.S. Gulf Coast, and in the North Sea are examples of fluvial-deltaic reservoirs.

The goal of the effort is to define fluvial-deltaic reservoirs so that three-dimensional models can be created of similar fields worldwide. Those kinds of reservoirs are known to contain significant oil reserves, and 3-D modeling leads to more effective and efficient management of them. The project focused on the Ferron Sandstone outcrop belt in east-central Utah. Although it contains no oil reserves itself, the Ferron Sandstone is exposed and accessible and is well-known throughout the oil industry as a natural model for studying fluvial-deltaic reservoirs.

In grading the efforts by the UGS, the DOE program officer, Robert Lemon, noted, "The contractor has completed an excellent technical effort. [The UGS has] demonstrated through

reports, publications, and oral presentations a high level of professional quality. Results from the outcrop and subsurface analysis have been useful to the oil industry."

The project was managed by Thomas C. Chidsey, petroleum section chief and senior scientist with the UGS. The final ratings for quality, cost control, timeliness of performance, business relations, and customer satisfaction were all "4s" on a scale of 1 to 4, with "4" being excellent.

UGS Oil Recovery Project Featured in Major Industry Journal

Continuing efforts by the Utah Geological Survey and its industry partners to enhance oil recovery in the Paradox basin of Utah have caught the attention of a major industry publication, *Oil & Gas Journal*.

The weekly magazine, published by PennWell Publishing of Tulsa, Oklahoma, is one of the major publications serving the oil and gas industry. It reaches approximately 32,000 readers in the United States and several other countries.

The story in the May 3 edition, "Paradox study shows big oil potential with CO₂," details an ongoing study, led by UGS scientists and its subcontractors, to use carbon-dioxide (CO₂) flooding to increase oil production. The Paradox basin, in the remote southeastern corner of Utah, has already produced more than 400 million barrels of oil, and probably contains at least that much more in reserves. Most of the production has come from the Greater Aneth field, a 75-square-mile region in the middle of

continued on next page....

Survey News

The UGS was awarded \$5,000 from the Assoc. of American State Geologists (funded by the National Science Foundation) to hire two student interns for the summer to work with geologic mappers. UGS is one of 20 states to receive funds.

Personnel Moves

Bryce Tripp is stepping aside as Program Manager effective May 29, to return to scientific duties.

Cory Bird has accepted another job with the state, but much closer to his home. One legacy he will leave behind is a new comprehensive budget analysis system that will allow each program to monitor budgets, project by project, on a monthly basis. As much as we will miss him, we wish him well at his new job even though those people are probably going to be a whole lot more boring than we are.

James Kirkland, Ph.D., is the new Chief of the Paleontology Section. Jim comes to Utah from the Dinamation International Society of Fruita, Colorado, where he was Senior Paleontologist. He earned geology degrees from the New Mexico Institute of Mining and Technology (B.S.), Northern Arizona University (M.S.), and the University of Colorado (Ph.D.). He is an adjunct professor of physical sciences at Mesa State College in Grand Junction, Colorado, and the author or co-author of more than 50 scientific pa-

pers on paleontology, including the descriptions of five new dinosaur genera.

Monson Shaver left the Environmental Sciences group to pursue private industry while **John Kingsley** has joined us as the Associate Director - he formerly worked with the office of Energy Services of DCED.

Basia Matyjasik is a new Geotechnician and **Alison Corey** is a new Geographic Information Systems (GIS) Analyst with the Environmental Sciences Program. **Denise Laes** has joined Mapping as a GIS Analyst. Welcome to you all!

Cheryl Wakefield is the new UGS receptionist, replacing **Linda Bennett**, who was promoted to Accounting Tech III. Congratulations to both!

Chris Eisinger and **Becky Gonzales** have left UGS for other endeavors.

Publications

David Madsen co-authored four articles: "The Loess/Paleosol Record and the Nature of the Younger Dryas Climate in Central China" was published in *Geoarchaeology: An International Journal*. "Pine Nut Use in the Early Holocene and Beyond: The Danger Cave Archaeobotanical Record" and "Mass Collecting and the Diet Breadth Model: A Great Basin Example" appeared in *Journal of Archaeological Science*. "The Fremont Complex: A

Behavior Perspective" was printed in *Journal of World Prehistory*. Mike Hylland co-authored "Stratigraphic and Structural Framework of Himalayan Foothills, Northern Pakistan," published as a Geological Society of America Special Paper.

Upcoming Meetings

Several members of the UGS staff are involved in planning professional conferences in 1999. **Cheryl Ostlund**, **Janine Jarva**, and **Tim Madden** worked on the Utah Geographic Information Council conference held at Snowbird from September 22 - 24. **Jeff Quick** coordinated efforts to bring the 16th annual meeting of The Society of Organic Petrology to Snowbird from September 26 - 30. **Bill Lund** and **Francis Ashland** are involved in the 42nd annual meeting of the Association of Engineering Geologists, held at Little America in Salt Lake City, September 26 - 29. **Mike Lowe** helped plan the Utah Geological Association Symposium and Field Conference.

Tom Chidsey and **Craig Morgan** made presentations to the American Association of Petroleum Geologists in Bozeman, Montana. And **Jeff Quick** and **Hugh Hurlow** will be presenters at the annual meeting of the GSA in Denver, Colorado, October 24 - 28.

Energy News continued.....

the basin. Surrounding that field are more than 100 smaller fields which research suggests could contain as much as another 150 million barrels of oil. That oil could be recovered using the same CO₂ techniques cur-

rently being employed in the Greater Aneth field.

The project is funded by the U.S. Department of Energy, National Petroleum Technology Office, in Tulsa, Okla-

homa. Additional funding for the project came from Harken Southwest Corporation of Houston, Texas, and the Utah Office of Energy and Resource Planning. The UGS is the prime contractor for the project.

Information Dissemination

During its 50 years, the UGS has operated under a mandate of getting pertinent geologic information to the public, including legislators, land-use planners, industry, teachers, geologists and other scientists, universities, and local, state, and federal officials.

This mission entails answering specific questions (“The Governor’s Office needs a complete summary of value and availability of strategic minerals,” “What was that blue rock I saw in the desert?”), and responding to specific requests (“We really need a coherent idea of how much recoverable coal is in that area, and a solid report.”). Publications serve the longer term; the early Survey depended heavily on them for finances, as evidenced by the Legislative directive to “derive income from publication sales.”

What has changed in 50 years? We have taken a more active role in disseminating geologic information. The Geologic Extension Service (GES) was established to answer inquiries on a daily basis, and to produce informative publications about Utah’s geology. An imposing amount of information is provided by GES staff over the telephone and through answers to letters and e-mail. We provide more in-

formation through posters and talks at scientific meetings, with several newsletters, and by providing public access to the DNR Library’s collection of geologic publications amassed during those 50 years.

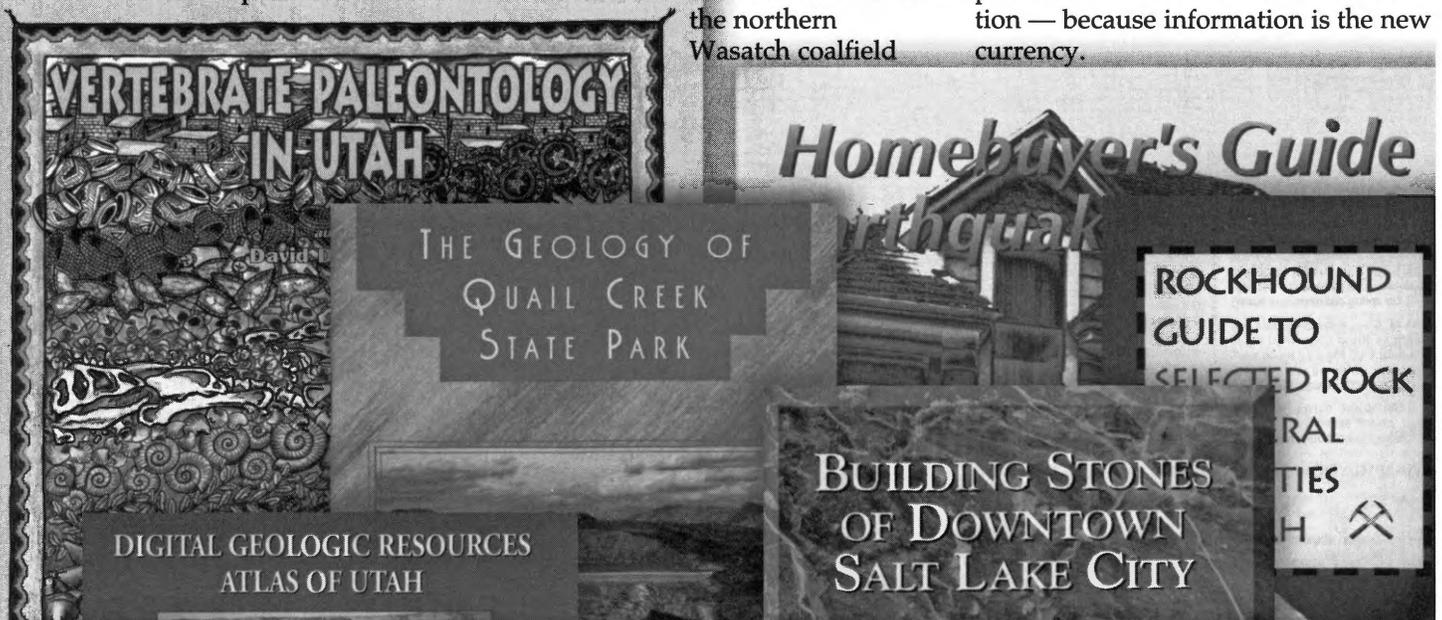
And oh, what a variety of publications. As the Walrus said, “. . . and thick and fast they came at last, and more, and more, and more . . .” From the humble beginnings of 4- to 8-page typed reports to a current publications list that has more than 650 entries, the UGS has produced — and continues to produce — reports and maps detailing everything from water resources to oil and gas reserves, metals to building stones, geologic hazards to the geology of state parks, sand and gravel potentials to tar sands and coalbed methane.

For instance, the UGS most recently published for the scientific audience a digital resource atlas of Utah on CD-ROM, which is chock full of geologic information that can be used to build commodity-specific maps or give overall views in several layers of information; studies of the petroleum geology of Cisco Dome and the gas fields in the PR Springs area; an examination of available coal resources of the northern Wasatch coalfield

that will help define future economic ideas about coal in Utah; and a collection of 52 papers on vertebrate paleontology in Utah that varies from summaries of current status to detailed analysis of new species or ideas. There are also maps — always maps: the newest are three 30’ x 60’ geologic maps at a scale of 1:100,000.

In recent years, publications for the general public have flourished. The latest are a rockhounds guide to selected rock and mineral localities in Utah, which joins a host of earlier information publications for people fascinated by Utah’s astonishing geology; a booklet detailing the geology of Quail Creek State Park; a pamphlet that takes the reader on a self-guided walking tour of building stones used in downtown Salt Lake City construction; and flyers answering the often-asked question, “What is the Grand Staircase?” and detailing the variety of metalliferous resources of Utah. These publications are colorful, easily understood ways to introduce information to a broader audience.

As we enter the second half of our century, the UGS is poised on the threshold of a new millennium that promises to demand more information — because information is the new currency.



New Publications of the UGS

- Digital geologic resources atlas of Utah, compiled by Douglas A. Sprinkel, 1 CD-ROM B-129DF **\$49.95**
- Allosaurus fragilis*, a revised osteology, by James Madsen Jr., is back in print again B-109 **\$9.00**
- A summary of the ground-water resources and geohydrology of Grand County, Utah, by Chris Eisinger and Mike Lowe, 28 p. C-99 **\$5.50**
- Rockhound guide to selected rock and mineral localities in Utah, by GES staff, color foldout PI-62 .. **\$1.25**
- The available coal resources for nine 7.5-minute quadrangles in the northern Wasatch Plateau coal-field, Carbon and Emery Counties, Utah, by D.E. Tabet, J.C. Quick, B.P. Hucka, and J.A. Hanson, 46 p. C-100 **\$9.00**
- Metalliferous resources of Utah, by M. R. Smith and M. R. Milligan, color brochure PI-57 **50¢**
- The Bluebell field drill-hole database, Duchesne and Uintah Counties, Utah, by Craig Morgan, has been updated to April 1999 C-90DF **\$5.95**
- Building stones of downtown Salt Lake City, a walking tour, by Christine M. Wilkerson, 24 p. PI-60 .. **\$2.75**
- Petroleum geology of the Cisco Dome area, Grand County, Utah, by C. D. Morgan, 4 pl. OGS-19 .. **\$13.00**
- Gas fields in the PR Springs area, Grand County, Utah, by Craig D. Morgan, 2 pl. OGS-20 **\$6.60**
- Delineation of drinking water source protection zones for the Green Hills Country Estates well 02, Weber County, Utah, by Charles E. Bishop and Mike Lowe, 24 p. + 15 p. appendix RI-240 **\$3.60**
- Delineation of drinking water source protection zones for the Newcastle public water supply well, Iron County, Utah, by C.E. Bishop, 51 p., + 20 p. appendix RI-243 **\$4.00**
- Progress Report - geologic map of the Ogden 30' x 60' quadrangle, Utah and Wyoming, Year 2 of 3, by Jon K. King, 27 p., 2 pl., 1:100,000 OFR-365 **\$4.50**
- The geology of Quail Creek State Park, by R. F. Biek, 21 p. PI-63 ... **\$3.50**
- Interim geologic map of the SE part of the Panguitch 30' x 60' quadrangle, Garfield and Kane Counties, Utah, by H. H. Doelling and G. C. Willis, 7 p., 1 pl., 1:100,000 OFR-367 **\$2.00**
- A summary of the Geologic Resource Atlas of Utah compiled by D. A. Sprinkel, 154 p. OFR-364 **\$13.50**
- Interim geologic map of the Kanab 30' x 60' quadrangle, Kane and Washington Counties, Utah, and Coconino and Mohave Counties, Arizona, by H. H. Doelling, 11 p., 2 pl., 1:100,000 OFR-366 .. **\$4.50**
- Interim geologic map of the Escalante and parts of the Loa and Hite Crossing 30' x 60' quadrangles, Garfield and Kane Counties, Utah, by H. H. Doelling and G. C. Willis, 19 p., 2 pl., 1:100,000 OFR-368 **\$5.25**
- Known and potential sand, gravel, and crushed stone resources in Grand County, Utah, by Greg N. McDonald, 21 p. 1 pl., scale 1" = 4 miles OFR-369 **\$4.25**
- What is the Grand Staircase?, by GES staff, 1 p. PI-64 **Free**
- Vertebrate paleontology in Utah, D.D. Gillette, editor, 553 p. MP99-1 **\$29.95**

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From 0 to 70 in 50 years....



As its responsibilities and involvements increased, so too did the staff of the Utah Geological Survey. Some of the scientists, technicians, and ancillary staff responsible for investigating, analyzing, interpreting, and bringing into the public arena the geologic history of Utah assembled recently on the steps of their latest home, the Department of Natural Resources building in Salt Lake City.



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