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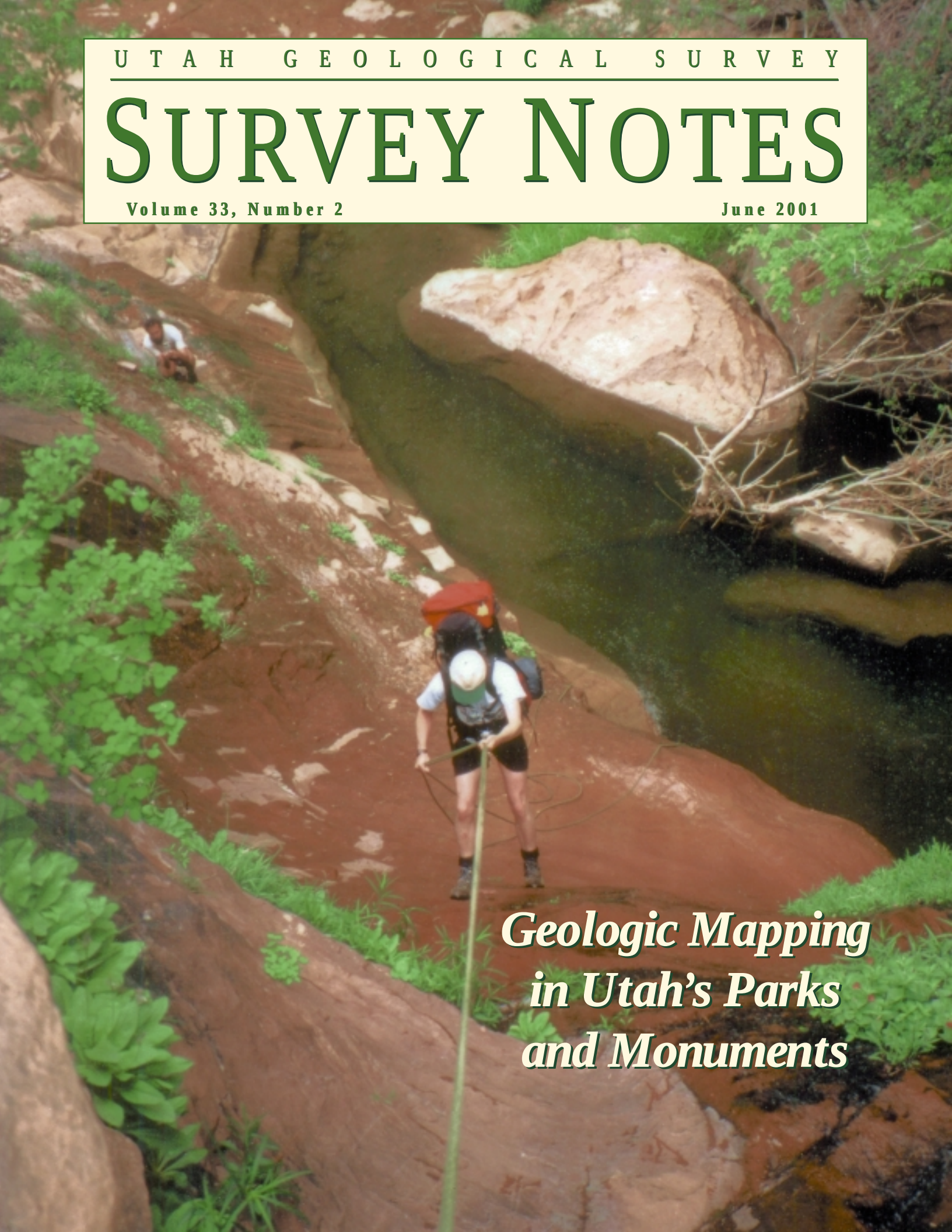

Geologic Mapping in Utah's Parks and Monuments

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Design by Vicky Clarke

Cover: *UGS geologist Grant Willis descends through the canyon of the Right Fork of North Creek while mapping in Zion National Park, southwestern Utah. Photo by Mike Hylland.*

The Director's Perspective

by Richard G. Allis

This issue of Survey Notes contains several articles from the Geologic Mapping Program of the Utah Geological Survey. Our traditional role of publishing hard-copy geologic maps is rapidly expanding due to changing technology. There is now widespread use of the Internet, and users expect to quickly access the information they seek. For example, during the mid-1990s, the UGS typically received about 2,000 queries per year, not counting inquiries to our bookstore. This number has decreased in recent years to about 1,500, but visitors to our website who stayed for more than 30 seconds (that is, interpreted as genuine website queries) have risen to around 3,000 per week (see Bill Case's notes on p. 12). Our website visitors have approximately doubled each year over the past four years, although there are signs in this year's statistics that the growth may have leveled off. In addition to the traditional maps sold from our bookstore, we can now print some maps on demand and save on print costs, and produce maps in Geographic Information System (GIS) format, either releasing them on CDs or making them accessible through the web. The digital age has allowed geologic information to be more accessible, and hopefully also to be in much greater use than a decade ago.

The technology of Internet map servers (IMS) has the potential to stimulate another vast increase in usage of geologic information during the coming decade. This technology allows anyone with Internet access to use GIS software on the map-server website to compile a personal map which can then be downloaded to their PC, or printed locally. Two factors need to be recognized for this to be widely used: firstly, the majority of Internet users are not GIS experts, so the IMS software must be non-GIS-user friendly; secondly, these users want access to diverse datasets including demographic, geographic, economic, and geologic information. As an example, a potential developer may want to know where urban corridors are, who the landowners are, who holds the water rights appropriations in the area, what the geological hazards are, whether oil and gas wells have been drilled nearby, and whether any sensitive wildlife habitats exist. Presently in Utah, this information would require an expert GIS user to hunt through half a dozen web sites, including those of the agencies responsible for overseeing the information bases and that of the agency making them uniformly accessible (the Automated Geographic Reference Center, AGRC).

An exciting development in Utah is that the AGRC is building a simplified IMS as described above. This coincides with a directive from Governor Leavitt that the state's electronic appearance be "customer-centric" rather than the present "department-centric." The prototype is being built around several geologic layers provided by the UGS. Once the "look and feel" of the website is finalized, numerous (potentially hundreds) other layers will be added. It is hoped that the IMS will be operational later this year. The UGS is keen to assist with this project – we believe that the more accessible geological information is, the easier it will be to demonstrate to the Utah taxpayer that the Survey has an important role to play in ensuring that wise land-use decisions continue to be made during Utah's continuing period of economic delopment.

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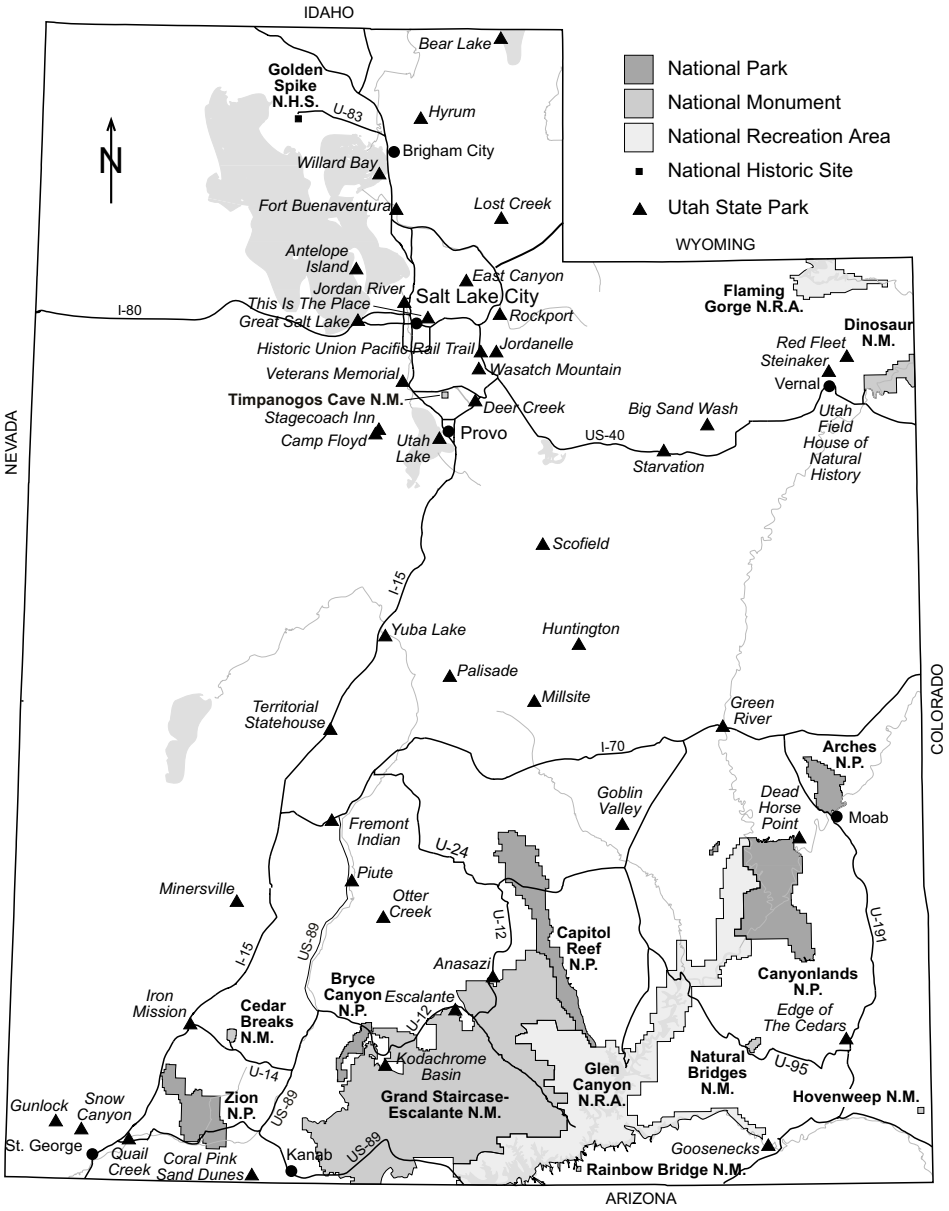
Geologic Mapping in Utah's Parks and Monuments

by Grant C. Willis and Douglas A. Sprinkel

Utah has been known by many titles over the years: "Deseret," "The Beehive State," even the "Jello State." But perhaps most appropriate would be "The Parks State," or, to us geologists, "The Geologic Parks State," for Utah has gained worldwide renown for its numerous state and national parks. Utah has some of the best examples in the world of classic geologic features, and many of these are showcased in our parks. Students and professionals alike come to study these features, and visitors from around the world come to experience the awe-inspiring geology.

As near as we can determine, Utah has a greater percentage of its land set aside as "parks" (as used here, the term includes national and state parks, monuments, recreation areas, and wildlife preserves) than any other state in the continental U.S. (over 4.2 million acres, or almost 8% of the state). Regardless of how some of these parks came to be, they represent a large part of Utah's economy and resources. The Governor's Office of Planning and Budget estimated that 17.8 million nonresidents visited Utah in 2000. They spent $4.25 billion, generated $340 million in tax revenue, and supported 121,500 travel and tourism jobs. Many of those visits were specifically to our national and state parks. And of course, Utah citizens get to enjoy these treasures more than any-



Map of Utah showing national and state parks, monuments, and recreation areas.

UGS geologists measure and describe Tertiary outcrops on Antelope Island.

UGS and Bureau of Land Management personnel review recent map of Grand Staircase - Escalante National Monument.

one. In 2000, resident and nonresidents together made 6.6 million visits to state parks and 5.4 million visits to national parks. Travel and tourism represent about 7 percent of the gross state product.

With Utah's famous scenery, it is no surprise that most of our parks were designated because of their geology. Whether it be the towering cliffs (Zion), deep canyons (Canyonlands, Capitol Reef, Dead Horse Point, Glen Canyon, Flaming Gorge), arches and bridges (Arches, Natural Bridges, Rainbow Bridge), fossils (Dinosaur, Escalante), caves and cave ornaments (Timpanogos Cave), complex geologic structures and geomorphic features (Antelope Island, Wasatch Mountain), unique erosional features (Goblin Valley, Bryce Canyon, Cedar Breaks), or the boldly colored rocks (Snow Canyon, Grand Staircase-Escalante, Kodachrome Basin, and most of the others!), all of our national parks, and most of our state parks, center around their geology.

Over the years, the Utah Geological Survey (UGS) has worked closely with the managers of many parks to help them map the geology, inventory their unique resources, develop management plans, and interpret these wonders for the public. We develop mapping projects in and around parks for several reasons, primarily: (1) to fulfill our mission to produce complete map coverage of the state at 1:100,000 and 1:24,000 scales, (2) to complete detailed maps of the areas around parks that are experiencing some of the most rapid urban growth and recreational development in the state, and (3) to help solve the many puzzles that make up Utah geology.

While mapping in Utah's parks may seem like a dream job (actually it is, but don't tell anyone), it also presents many unique challenges. After all, Utah's parks are noted more for their remote canyons than they are for their convenient access. For example, mapping Antelope Island during the late 1980s required a weekly boat trip or airplane flight; mapping the back country of Zion National Park meant rappelling cliffs and swimming icy pools at the bottom of the narrow canyons. In addition, park regulations make sampling and other mapping activities more difficult. In some areas no sampling is allowed under any conditions, and even where sampling is allowed, special permits are required.

Though studies of cost-benefit ratios repeatedly show that geologic mapping yields a large positive benefit to society, geologic mapping is expensive. For example, we have heard managers of mineral exploration companies state that they will not explore in areas that do not have good geologic maps because it is too expensive to map themselves. Thus, one of the benefits of mapping projects in the parks is that we have often been able to develop cooperatively funded projects that share the expenses, and that benefit everyone. For example, even though the UGS and National Park Service (NPS) jointly funded the work, more than 50 percent of our recent mapping of Zion National Park covered adjoining areas outside the park. These areas include communities, such as Springdale and Rockville, and a large part of the Interstate 15 and State Highway 9 corridors that are experiencing rapid growth. By mapping beyond park boundaries, we not only gain a clearer understanding of the regional geology, but we are also able to benefit the local communities.

Following is a summary of some Geologic Mapping Program recent projects.

Antelope Island State Park - An Outdoor Classroom

In the late 1980s, while the park was cut off from the mainland by high

lake levels, the Division of Parks and Recreation developed a master plan for managing Antelope Island State Park. As part of that plan, they requested that the UGS complete a new 1:24,000-scale geologic map of the island. Today that map is a popular sales item in the visitor center. While mapping, we recognized that the island has spectacular exposures of many unique geologic features, ranging from the best exposures of some of the oldest rocks in the state, to some of the youngest rocks that are forming on the Great Salt Lake beaches today. Because those exposures reflect many basic geologic principals, and due to the island's proximity to the Wasatch Front, we recommended that the master plan consider the island as an outdoor geologic classroom. Today, many students and fans of geology enjoy the trails that lead through some of the best exposures on the island.

Zion National Park

In 1996, the UGS entered into an agreement with the NPS to produce a detailed 1:24,000-scale map of Zion National Park. This project will produce detailed maps of nine 7.5' quadrangles. As mentioned above, one of the beneficial parts of this project was that it also covered as much area outside the park boundaries as inside. It is also providing new information on many bedrock formations, basalt flows, and landslide and basalt-flow dams and their related lake deposits. Funding provided through the cooperative agreement will also allow these maps to be produced and made available in digital format.

Grand Staircase-Escalante National Monument

During the early 1990s, much activity was directed towards developing the vast coal deposits on the Kaiparowits Plateau. The UGS recognized the need for better maps of those coal resources, and began a mapping program in the area. That all changed with a quick stroke of the President's pen. Suddenly, we had a new national monument that needed a management plan. We quickly changed course and adapted our new mapping to produce a 1:100,000-scale geologic map of the monument. The draft digital file was given to the monument planning team to help develop their management plan.

UGS geologist studies outcrop of Navajo Sandstone in Zion National Park.

Glen Canyon National Recreation Area

During a series of meetings held during 1999, the NPS identified as one of its largest needs a better geologic map of Glen Canyon National Recreation Area around Lake Powell. At the same time, the UGS needed better mapping of the same area to continue its goal to produce digital geologic maps of the state -- thus, another opportunity to share the costs of a much needed map. Today, the UGS is working on a project with the NPS to complete a map of this vast area.

Flaming Gorge National Recreation Area

Mapping 30'x60' quadrangles is the main way we meet our goal to produce digital and printed maps of the state. Currently, we are mapping several quadrangles, including the Ogden, Delta, Wah Wah Mountains North, Tule Valley, Richfield, San Rafael Desert, and Dutch John. One of the largest of these projects is the Dutch John quadrangle, which includes all of the Utah portion of Flaming Gorge National Recreational Area. This project is jointly funded by the UGS and the National Cooperative Geologic Mapping Program administered by the U.S. Geological Survey. One of the reasons for prioritizing this project is the high recreational use that the Flaming Gorge area receives.

UGS geologist rappels into North Creek Canyon while mapping Zion National Park backcountry.

Other Parks

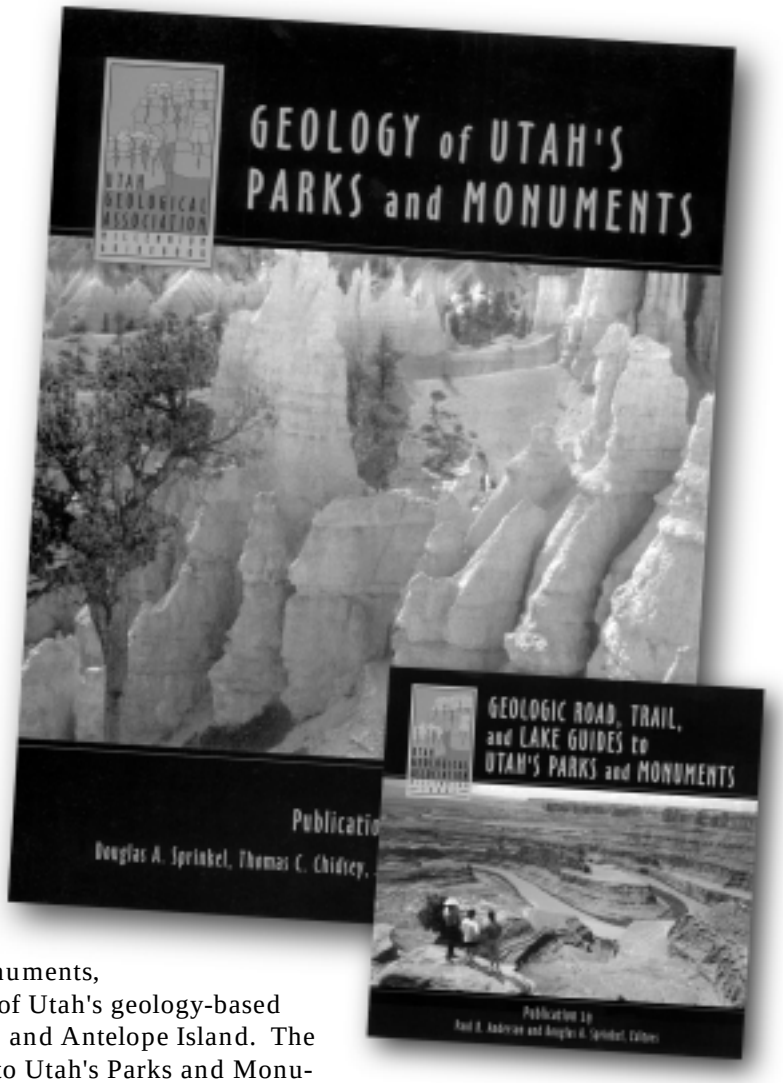
In recent years, the UGS has also had mapping projects that covered Arches and part of Canyonlands National Parks; Dead Horse Point, Snow Canyon, Quail Creek, and several other state parks; and many areas outside of the parks. By seeking out opportunities for sharing the expense with other government agencies, we have been able to significantly expand our mapping effort, contribute to the geologic knowledge of our state and national treasures, and produce many derivative guides and reports that help park managers explain Utah's fascinating geology to millions of visitors.

Utah Geological Survey Geologists Contribute Significantly to Millennium Guidebook and Geologic Guides

by Douglas A. Sprinkel

Millions of visitors to Utah's parks and monuments are captivated by the variety of plants and wildlife that call the parks home. However, it is the landscape, the cliffs and canyons, and the odd rock formations—in a word the geology—that leaves the visitor awestruck. For decades, geologists have come to Utah to study its geology and to explore for a variety of geologic resources—and Utah does have a wealth of geologic resources. However, the well-exposed geology itself may be the most important resource that Utah has to offer to future generations of geologists, as well as to casual sightseers.

Geologists of the Utah Geological Survey (UGS) have spent their careers studying and mapping the geology, resources, and hazards of the state; many of us have been lucky enough to work in and around Utah's parks. What we discover in these parks and report in our publications helps the people of Utah, and its visitors, to understand better why this state is so special. Our reports also provide baseline information to other geologists who come to Utah to work or lead field trips. This past year, geologists of the UGS had the opportunity to report on their past and current work in and around many parks in two special millennium volumes published locally by the Utah Geological Association (UGA). The first volume, Geology of Utah's Parks and Monuments, is a collection of richly illustrated articles that describe the geology of all of Utah's national parks, monuments, and two recreation areas. It also includes articles on 10 of Utah's geology-based state parks, including Goblin Valley, Kodachrome Basin, and Antelope Island. The second volume, Geologic Road, Trail, and Lake Guides to Utah's Parks and Monuments, is a compact disc that contains geologic travel guides for many of these same parks. Both of these volumes are published in full color and are written to appeal to a broad audience. They contain general information with explanations geared for the weekend hobbyist, as well as new data and information that will appeal to experienced geologists. UGS geologists made significant contributions to both volumes; collectively they wrote or co-wrote about half of the articles. Geologists of the UGS have a long history of contributing to volumes such as these, and of supporting the UGA and other local geologic organizations. After all, interpreting the geology is what we love to do!



Covers of new UGA Millennium guidebook and CD-ROM disc of new UGA Millennium road, trail, and lake guide.

"Glad You Asked"

by Mark Milligan and William F. Case

"Where can I collect landscaping rock on public land?"

Landscaping rock or "decorative stone "can be collected from "common use areas" or "community pits" on U.S. Forest Service and Bureau of Land Management (BLM) public lands in various locations across the state. Common-use areas/community pits are for noncommercial or small-scale collection and require a permit. The rules and stipulations for collecting vary from region to region and pit to pit. Blasting is generally not allowed, but some pits allow the use of heavy equipment. Other pits or areas only allow hand loading and excavating. For details on obtaining a permit, call the appropriate permitting office listed in the accompanying table. Local offices may refer to such permits as "special use permits," "mineral material permits," or "over the counter sales."

While this article only lists decorative stone collecting areas, other earth materials such as sand box sand, clay, and sand and gravel are also available from public lands. If you wish to collect a material or rock type not listed or from a public land site not identified, contact your local BLM field office or National Forest ranger district. They may be able to issue a permit for your proposed site or redirect you to an appropriate area with similar material.

Collecting decorative stone as described in this article is subject to different rules and regulations than rockhounding (collecting small samples of rocks, minerals, and common invertebrate and plant fossils - less than 25 pounds per day and 250 pounds per year). For rockhounding information consult Rules and Regulations Regarding Rock, Mineral, and Fossil Collecting in Utah (PI-23), available for free from the Natural Resources Map and Bookstore - (801) 537-3320, or toll free 1 (888) UTAHMAP.

Decorative stone public collecting localities. Material names and locations are as reported by the permitting office. Permits must be obtained prior to collection of material.

Permitting Office and Phone number	**Pit Name or Location Name**	**7.5 Min. Topo Map** (unless otherwise indicated) **Section (S), Township (T) & Range (R)**	**Material**	**Cost (royalty & reclamation fee)**
BLM - Cedar City (435) 586-2401	Stephens Canyon	Cedar City S 12, T.36 S., R.11 W.	red sandstone, Navajo Sandstone	$8/ton, $10 minimum
BLM - Cedar City (435) 586-2401	Milford Rock Quarry	Milford S 33, T.27 S., R.11 W.	granitic	$8/ton, $10 minimum
BLM - Cedar City (435) 586-2401	Bear Valley Greenstone	Little Creek Peak S 34, T.32 S., R.6 W.	green flagstone	$8/ton, $10 minimum
BLM - Cedar City (435) 586-2401	Mt. Spring Peak	Mountain Spring Peak S 11, T.32 S., R.16 W.	volcanic cobbles & boulders	$7/ton, $10 minimum
BLM - Cedar City (435) 586-2401	Sulphurdale	Cinder Crater S 17, T.26 S., R.7 W.	red & black cinder	$0.80/ton, $10 minimum
BLM - Cedar City (435) 586-2401	Rush Lake	Cinder Crater S 22, T.26 S., R.7 W.	red cinder	$0.80/ton $10 minimum
BLM - Cedar City (435) 586-2401	Three Hills	Cinder Crater S 22, T.26 S., R.7 W.	cinder	$7/ton, $10 minimum

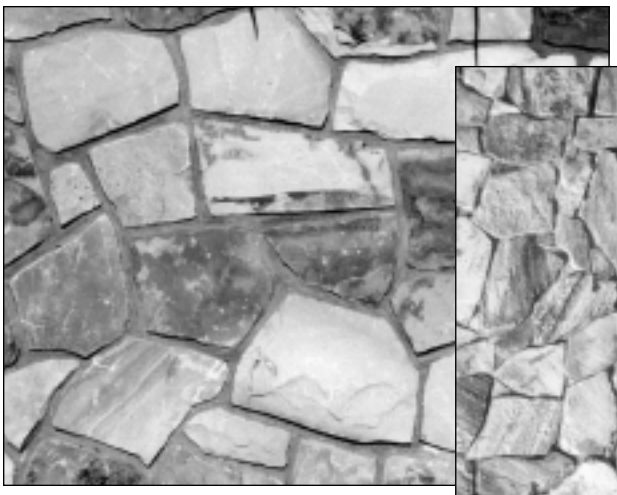
BLM - Henry Mountain (435) 542-3461	East Edge of Torrey	Torrey S 17, T.29 S., R.5 E.	red sandstone, Moenkopi Fm	$12/ton, $10 minimum
BLM - Salt Lake (801) 977-4300	West Mountain	West Mountain S 15, T.15 S., R. 1E.	quartzite ashlar & boulders	$9/ton
BLM - Salt Lake (801) 977-4300	Kimbell Creek	Kimbell Creek S 23, T.13 N., R.17 W.	quartzite flagstone & boulders	$9/ton
BLM - Salt Lake (801) 977-4300	N. Wiley Canyon	Saratoga Springs S 21, T.6 S., R.1 W.	quartzite, limestone, & dolomite ashlar	$9/ton
BLM - Salt Lake (801) 977-4300	Rosebud	Emigrant Pass S 14, T.10 N., R.16 W.	quartzite flagstone	$9/ton
BLM - Salt Lake (801) 977-4300	Grouse Creek Jct.	Lucin NW S 26, T.9 N., R.19 W.	white volcanic tuff	$9/ton
BLM - Salt Lake (801) 977-4300	Stansbury Island 21 Staging Area	Corral Canyon S 21, T.1 N., R.6 W.	quarried quartzite boulders	$9/ton
BLM - Salt Lake (801) 977-4300	Stansbury Island 21 Landscape Rock Area	Corral Canyon S 21, T.1 N., R.6 W.	weathered quartzite boulders	$9/ton
BLM - Salt Lake (801) 977-4300	Grayback Hills Landscape Rock Area	Aragonite NW S 12, T.1 S., R.12 W.	basalt boulders	$9/ton
BLM - Kanab (435) 644-4600	Bitter Seeps	Pipe Spring (Arizona) S 6, T.39 N., R.3 W.	flagstone, Moenkopi Fm	$8/ton, $10 minimum
BLM - Kanab (435) 644-4600	Shinarump Pit	Johnson Lakes S 31, T.43 S., R.4 W.	sandstone & conglomerate boulders	$8/ton, $10 minimum
BLM - Kanab (435) 644-4600	Red Canyon	Wilson Peak S 21, T.35 S., R.4 1/2 W.	volcanic boulders/ rip rap	$8/ton, $10 minimum
BLM - Kanab (435) 644-4600	Alton	Alton S 31, T.39 S., R.5 W.	clinker	$8/ton, $10 minimum
BLM - Price/San Rafael (435) 636-3600	Old Woman Wash	Old Woman Wash S 5, T.25 S., R.13 E.	red sandstone	$5.57/ton, $10 minimum
BLM - Price/San Rafael (435) 636-3600	Red's Canyon	Tomisch Butte S 18 & 19, T.24 S., R.9 E.	red sandstone	$5.57/ton, $10 minimum
BLM - Price/San Rafael (435) 636-3600	San Rafael River	Devils Hole S 19 & 30, T.20 S., R.12 E.	red sandstone	$5.57/ton, $10 minimum
BLM - Price/San Rafael (435) 636-3600	Willow Springs	Mussentuchit Flat S 12, T.24 S., R.6 E.	basalt boulders	$5.57/ton, $10 minimum
BLM - Price/San Rafael (435) 636-3600	Red Seeps	Buckhorn Reservoir S 12, T.19 S., R. 9 E.	"pock-marked rock"	$5.57/ton, $10 minimum
BLM - Vernal (435) 781-4400	West Wrinkles	Cowboy Bench S 15 & 22, T.11 S., R.15 E.	"float" stone on surface, Green River Fm	$13/ton
BLM - Vernal (435) 781-4400	Buck Canyon	Agency Draw NE S 35, T.12 S., R.21 E.	"float" stone on surface, Green River Fm	$13/ton
BLM - Fillmore (435) 743-3100	Obsidian Community Pit	Antelope Spring S 14, T.24 S., R.9 W.	obsidian	$0.0125/pound, $25/ton
BLM - Fillmore (435) 743-3100	Topaz Mountain Community Pit	Keg Pass S 19-35 (except 32), T.11 S., R.10 W.; S1-18 (except 2), T.12 S, R.10W.; S1-35 (except 2 & 32), T.12 S., R. 11 W.	gray "lace rock"	boulders = $14/ton, aquarium rock = $20/ton
BLM - Fillmore (435) 743-3100	"Lace Rock"	Dugway Range SW S 4, T.12 S., R.12 W.	gray "lace rock"	boulders = $14/ton, aquarium rock = $20/ton
BLM - Fillmore (435) 743-3100	Honeycombs	Hole-in-the-Wall Reservoir & Middle Range North S 6 & 7, T.13 S., R.15 W.; S 1 & 12, T.13 S., R.16 W.	gray "lace rock"	boulders = $14/ton, aquarium rock = $20/ton
BLM - Fillmore (435) 743-3100	Red Wash	Burnout Canyon S 14 & 15, T.22 S., R.13 W.	red "lace rock"	boulders = $14/ton, aquarium rock = $20/ton

BLM - Fillmore (435) 743-3100	Lawson Cove	Wah Wah Summit & Grassy Cove S 11, T.25 S., R.15 W.	"zebra rock"	$20 / ton
BLM - Fillmore (435) 743-3100	Antelope Point	Pinnacle Pass & Antelope Spring S 2 4, T.25 S., R.9 W.	volcanic boulders	$7.50 / ton
BLM - Fillmore (435) 743-3100	School Bus Corral	Iron Mine Pass S 5 & 6, T.25 S., R.12 W.	iron-coated cobbles	$0.80 / ton
BLM - Fillmore (435) 743-3100	Wheeler Slate	Marjum Pass S 12 & 23, T.17 S., R.13 W.	carbonaceous shale, Wheeler Fm	$3 reclamation fee plus $10 / ton
BLM - Fillmore (435) 743-3100	Basin Creek	Mud Lake Reservoir S 8 & 9, T.11 S., R.17 W.	granite boulders	$7.50 / ton
BLM - Fillmore (435) 743-3100	Lakeview Reservoir	Iron Mine Pass S 29, T.24 S., R.12 W.	flagstone - quartzite	$7.50 / ton
BLM - Fillmore (435) 743-3100	Volcanic Cinders	Antelope Spring S 24, T.25 S., R.9 W.	landscape cinders	$0.50 / ton
BLM - Fillmore (435) 743-3100	Monument Point	Headlight Mountain S 13, T.23 S., R.11 W.	iron-stained quartzite boulders	$7.50 / ton
BLM - Fillmore (435) 743-3100	Antelope Spring	Antelope Valley & Cinder Crater S 4, T.25 S., R.8 W.	jasper	$0.0125 / pound, $25 / ton
BLM - Dixie (435) 688-3246	Virgin Flagstone	Virgin S 29, T.41 S., R.12 W.	hard limey flagstone	$12 / ton, $10 minimum
BLM - Dixie (435) 688-3246	South Hurricane Rock Area	The Divide S 22, T.43 S., R.13 W.	red sandstone landscape boulders	$12 / ton, $10 minimum
Wasatch-Cache NF Salt Lake RD (801) 466-6411	Big Cottonwood Canyon	Mount Aire & others along the canyon road	various rock types Collecting river rock is prohibited	A no fee permit is required. Hand collection only.
Uinta NF Heber RD (435) 654-0470	Hwy 40 in Daniel's Canyon near McGuire Hollow	Center Creek & Twin Peaks S 6, 7, 8, 17, 18, 20, 31, & 32, T.5 S., R.6 E.	flagstone	A no fee permit is required. Hand collection only.
Manti-La Sal NF Sanpete, Ferron, & Price RDs (435) 637-2817 ask for Jeff DeFreest	no designated sites, but a free use permit may be issued for user requested sites	1:126,720 scale; Manti- La Sal NF - Sanpete, Ferron, & Price RDs Map	various	A no fee permit is required.
Manti-La Sal NF - Moab RD (435) 259-7155 Monticello RD (435) 587-2041	no designated sites, but a free use permit may be issued for user requested sites	1:126,720 scale; Manti- La Sal NF - Moab & Monticello RDs Map	various	A no fee permit is required. Hand collection only.
Fishlake NF (435) 896-9233	no designated sites, but a free use permit may be issued for user requested sites	1:126,720 scale; Fish Lake NF Map	various	A no fee permit is required.
Dixie NF (435) 865-3200	no designated sites, but a free use permit may be issued for user requested sites	1:126,720 scale; Dixie NF - Pine Valley & Cedar City RDs Map, & Powell, Escalante & Teasdale RDs Map	various	A no fee permit is required.
Ashley NF (435) 789-1181	no designated sites, but a free use permit may be issued for user requested sites	1:126,720 scale; Ashley NF - Flaming Gorge & Vernal RDs Map, & Roosevelt & Duchesne RDs Map	various	A no fee permit is required. Hand collection only.

BLM = Bureau of Land Management
NF = National Forest
RD = Ranger District
Fm = Formation

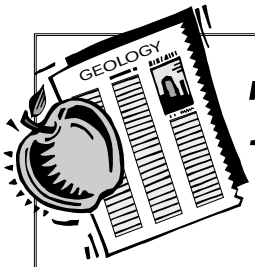
Maps available from:
Natural Resources Map & Bookstore
1594 W. North Temple
Salt Lake City, UT 84116
(801) 537-3320 or (888) UTAH MAP (toll free)

Zebra rock from Millard, County, Utah.



Nugget Sandstone from Park City, Utah.

Quartzite from Box Elder County, Utah.



Teacher's Corner

Teaching packets with activities - on the web! from the U.S. Geological Survey

The U.S. Geological Survey (USGS) has great teaching packets for various grade levels. These packets have been redesigned to be fully deliverable from the Web.

Exploring Caves: K-3; Bat finds two lost children in a cave and teaches them various lessons as he guides them to safety. Includes poster, lesson plans, and activity sheets.
www.usgs.gov/education/learnweb/caves/

Map Adventures: K-3; how to understand and use maps. Includes poster, lesson plans, and activity sheets.
HTML: www.usgs.gov/education/learnweb/MA/
PDF: mapping.usgs.gov/mac/isb/pubs/teachers-packet/mapadventures/mapadven.html

What do Maps Show?: 4-6; learn geography and develop map reading skills. Includes poster, lesson plans, maps, and activity sheets.
www.usgs.gov/education/teacher/what-do-maps-show/index.html

Global Change: 4-6; time, change, natural cycles, and Earth as home. Includes poster, teacher guide, lesson plans, and activities.
HTML: www.usgs.gov/education/learnweb/GC.html
PDF: mapping.usgs.gov/mac/isb/pubs/teachers-packets/globalchange/global.html

Volcanoes!: 4-8; learn about the different types of volcanoes and about Mount St. Helens. Includes poster, teaching guide, glossary, lesson plans and activities.
www.usgs.gov/education/learnweb/volcano/

Exploring Maps: 7-12; basic map making and map reading skills. Includes posters, teaching guide, and activities.
www.usgs.gov/education/learnweb/Maps.html

Land and People: 9-12; examine current environmental issues in three different regions and help prepare to find a balance between humans and the environment in the future. Includes role-playing activities and scientific data about the regions.
www.usgs.gov/education/learnweb/LandPeople/

While you are visiting web sites, don't forget to look at the UGS page on Educational Resources at http://www.ugs.state.ut.us/tcorner.html#inservice. This site describes the UGS resources for teachers, including kits for loan and any upcoming teacher workshops/field trips.

UGS' Prehistory and Heritage Week Celebration Successful

During Utah's Prehistory and Heritage Week (May 7-11), the Utah Geological Survey (UGS) Sample Library hosted tours and activities for 667 school-age children. During their 1 1/2-hour visit, the children learned about rocks, minerals, and dinosaurs. They rotated through four different sessions: investigating mineral properties of fluorescence, hardness, streak color, and calcium carbonate content; looking at the unusually round grains of the oolitic sand through a microscope; seeing fossils and how they are extracted; and gold panning. The children left with bags of goodies containing a fossil cast of their choosing and several rock and mineral samples.

The week's activities were highlighted with the famous and colorful paleontologist, Dr. Robert T. Bakker. His delightful, enthusiastic, and fun-filled presentations to both the media and public visitors enchanted all as he brought prehistoric creatures to life. Dr. Bakker also showed off the first Brontosaurus head to be found intact and concluded the day with his presentation to the Utah Friends of Paleontology and public visitors on *The Real Jurassic Park Is In Utah: Dinosaur Family Values*.

A special thanks goes to Martha Hayden (Paleontology Assistant) and Carolyn Olsen (Sample Librarian) for the great job of organizing and leading this affluent year of events. Kudos also are extended to the many volunteers who helped with the week's success. Volunteers included members of the Utah Friends of Paleontology; Utah Geological Association; Division of Oil, Gas and Mining; Division of Water Rights; and UGS staff.

UGS News

The UGS Board has changed with the April meeting. New members are Geoff Bedell (Kennecott), Steve Church (Sinclair Oil) and Ron Bruhn (U. of Utah). They replace outgoing members D. Cary Smith, C. William Berge, and Richard Kennedy. Thomas Faddies is currently representing School Trust Lands. The UGS Board also approved our amended Program names: Energy and Mineral Resources, Geologic Hazards, Geologic Mapping, Environmental Sciences, and Geologic Information and Outreach.

James McBride has left the Geologic Hazards Group where he was working on GIS. He now works for Weber County. Neil Storey has just joined us as his replacement.

Three members of the Energy and Resource Planning Office have joined forces with the UGS Energy and Mineral Resources Program. Tom Brill, F.R. Jahan Bani and Glade Sowards will bring an additional strength as an energy economics group.

Energy News

Are energy resources available in Utah to meet its future electricity needs?

by David Tabet

Utah's year 2000 electricity usage was met by coal (94.5%), natural gas (2.8%), hydroelectric (2.2%), geothermal (0.4%), oil (0.1%), and a small amount of solar energy resources. However, with current generating capacity soon to be eclipsed by growing demand, the question being asked by industry and government officials is: what energy sources will provide electricity for Utah in the future?

Three utilities have proposed additional coal-fired units to existing power plants as part of the mix of new power generating capacity. The proposed 1,350 megawatts of new coal-fired plants would likely consume an additional 4 million tons of coal per year above the 13.5 million tons of coal burned by current utility plants. Coal has been the staple fuel for Utah's utilities because it is cheap, readily available, and easily stockpiled. Recent studies of the central Utah coalfields by the Utah Geological Survey (UGS) indicate that there are sufficient resources, at current market conditions, to provide fuel for new and existing power plants, and other uses, for about 50 more years. Additional coal could be mined at higher prices, or if desulfurization units were added to all plants to allow higher sulfur coal to be used.

New gas-fired generating units have also been proposed as part of the supply mix of future capacity, which would significantly increase the current gas-generating capacity to 6 percent of the total system. Although gas is cleaner burning than coal, gas is several times more expensive than coal and in recent years has had greater price volatility. In addition, gas does not lend itself to easy bulk storage at the power plant. Since gas-fired generating units are quicker and less expensive to build, such units will probably help make up the state's generation capacity shortage in the next year or two, while new coal-fired units are being permitted and built. Utah's year-end 1999 proven gas reserves of 3.2 trillion cubic feet could supply the planned and existing gas-fired electric generators of the state for about 12 years. High levels of gas exploration and development in Utah have pushed proven gas reserves up for the past several years, and room for additional expansion at current fields will likely continue this trend for the next 5 to 10 years. It should be noted that identified gas reserves have a much shorter estimated life than coal.

In addition to fossil fuels, clean renewable sources of energy are likely to play a greater role in diversifying and expanding Utah's future electricity supply mix. Geothermal power currently supplies about 0.4 percent of the generating capacity. While no new geothermal plants have been announced to date, the UGS, in cooperation with the Utah Office of Energy, is evaluating the state's geothermal sources to see where expansion of this resource is economically feasible. If electric power costs continue to remain high, geothermal power generation in the state could easily be doubled. Geothermal power, unlike some other renewables, has the advantage of being available for use at all times of the day.

Technological improvements in the cost to generate electricity from other renewable energy sources has allowed wind power, pumped energy storage, and solar power to be considered in the future mix of power sources. Recent advances in turbine design and efficiency have made wind power cost-competitive with fossil fuels on a generated cost basis. Pumped fluid energy storage allows excess energy capacity that is available during off-peak hours to be stored as gravitational energy for use during subsequent peak need times. While the availability of wind power is as fickle as the wind, overall power availability from a wind facility could be enhanced by combining it with a pumped storage facility. Solar power, which currently generates 0.3 gigawatt hours of electricity (enough to power 38 average homes for a year), is a viable source of power in remote areas not served by current transmission lines. Some future electricity demand may also be offset by conservation measures such as switching to more efficient lighting and appliances, or the incorporation of passive solar design in new buildings. In addition, other demand may be offset if some users turn to cogeneration of their own electricity.

GeoSights

The Stockton Bar, a Geologic Treasure in Tooele County

by Holly Godsey Bennett and Marjorie A. Chan, Geology and Geophysics Dept.,
Donald R. Currey and Genevieve Atwood, Geography Dept.,
University of Utah, Salt Lake City

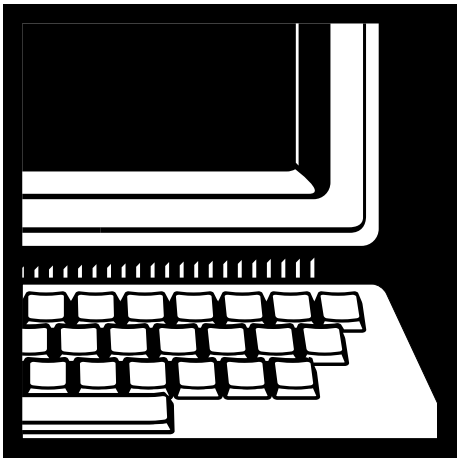
Geologic information: The Stockton Bar, south of Tooele, is one of the largest and most well-preserved shoreline remnants of Lake Bonneville. Lake Bonneville was a large fresh-water lake that occupied much of western Utah during the last ice age. At its maximum level, about 18,000 years ago, the lake was almost 1,200 feet deep and covered over 20,000 square miles. Waves and currents transported sediments along the shoreline of Lake Bonneville and created beaches, sandbars, and spits. These features, now perched high above the desiccated basin floor, provide evidence of this ancient lake.

View of the Stockton Bar from South Mountain looking east toward the Oquirrh Mountains.

Grove Karl Gilbert, a geologist with the Powell Survey, was the first to recognize the Stockton Bar as a giant, lake-formed sandbar when he passed through the area in 1877. He returned three years later as a member of the U. S. Geological Survey to map in detail "The Great Bar at Stockton, Utah."

The Stockton Bar formed as waves and currents brought sediments from the north and deposited them in the strait between South Mountain (directly west of the town of Stockton) and the Oquirrh Mountains. The Stockton Bar is actually made up of several sandbars and spits built upon one another as the level of the lake fluctuated. Each sandbar contains unique information about lake and climate conditions at the time it was formed. Wave energy, current direction, wind speed, lake chemistry, and precipitation and evaporation levels are just a few of the environmental conditions that can be interpreted from the Stockton Bar sediments. The deposits of the Stockton Bar are also unusual in that they contain a nearly continuous record of geologic history that spans several thousand years of Utah's last ice age (most other Bonneville deposits are discontinuous or only span a short interval of time). Few, if any, lakeshore bars can compare to the Stockton Bar in terms of size and quality of preservation. The bar is valued as both a natural landscape and a sand and gravel resource.

How to get there: From Tooele, Tooele County, Utah, drive south on Highway 36 about 5 miles. The best view can be obtained by turning west onto one of the many dirt roads that cross the bar at this point. A profile view can be seen by continuing south on Highway 36 to the town of Stockton. To access the southern side of the Stockton Bar, turn west off of Highway 36 just south of Stockton onto the access road to Rush Lake.



Who accesses the Utah Geological Survey web site, when do they access it, what at do they look at, and how long do they look?

by William F. Case

The Utah Geological Survey (UGS) web site, http://www.ugs.state.ut.us, provides information about Utah geology from various sources, particularly the UGS. Christine Wilkerson, UGS, is the Webmaster.

The following statistics were recorded by statistical software on a Utah state server. The statistical sampling period is from January 1, 2001, to April 24, 2001, 114 days. During the sampling period the entire UGS web site had 607,641 hits on all file types (text page, graphic, pdf), an average of 5,330 hits/day. A "hit" is recorded when a file is merely opened, sometimes in passing through to get to another file. A "visit" is recorded when someone opens a file and stays awhile, presumably reading the data. There were 76,220 visits (668 visits per day) lasting an average of seven minutes and 44 seconds per visit

Who accesses the UGS web site?

The visitor's geographical area recorded is not necessarily where the visitor resides. If a visitor uses an Internet service provider or web-hosting service, the location of the service is counted as the location of the visitor. America Online (aol.com), for example, is based in Virginia, and UUNET (uu.net) has offices in Virginia, California, Massachusetts, and Utah. Some visitors are not people; search engines have "spiders" that roam the web and "capture" web page titles and keywords for their database.

• The top 15 most active countries that accessed the UGS site in 2001, in decreasing activity order, are: United States, Canada, United Kingdom, Australia, Netherlands, France, Italy, Germany, Japan, Mexico, Belgium, Spain, Portugal, Singapore, and New Zealand.

• The top 10 most active states are: Virginia, California, Utah, Connecticut, Massachusetts, Washington, Colorado, Texas, Illinois, and Georgia.

• The top 10 most active cities are: Reston, VA; Redwood City, CA; Fairfax, VA; San Mateo, CA; Stamford, CT; Sunnyvale, CA; Provo, UT; Cambridge, MA; Salt Lake City, UT; and Logan, UT.

• The five most active organization types are company, network, education, government, and military.

When do they access the UGS web site?

• A little over 50% of all visitors access the UGS web site during working hours (8 a.m. – 5 p.m. MST) with peak activity from 11 a.m. to 2 p.m. The after- working-hours activity peak is from 10 p.m. to 11 p.m.

What do they access at the UGS web site?

• The topics of most accessed pages are, in no activity order: rock hounding, ice age, Great Salt Lake & Lake Bonneville, dinosaurs, trilobites, Utah earthquakes, geological links and, using a link to the Natural Resources Map & Bookstore web site (www.maps.state.ut.us), online publications, and topographical maps.

• The topics of the most downloaded files include earthquakes, mineral activity in Utah, Survey Notes issues, rock hounding, petroleum information from federal grant projects, the Utah geologic map, the UGS publications list, and information about the Grand Staircase-Escalante National Monument.

• The most common geologic keywords that visitors ask search engines to look for, in order of decreasing use, are: Utah, lake, map, salt, age, ice, rocks, maps, and geological.

How long do they stay?

• The average length of a visit to a popular page is about 1 minute 33 seconds.

New Publications from UGS

Paleontological survey of the Grand Staircase-Escalante National Monument, Garfield and Kane Counties, Utah, by John R. Foster, Alan L. Titus, Gustav F. Winterfeld, Martha C. Hayden, and Alden H. Hamblin, 98 p., 4/01, SS-99 . . . . . **$13.00**

Delineation of drinking water source protection zones for Warm Spring, a public-water-supply spring, Iron County, Utah, by Charles E. Bishop, 39 p., 4/11, RI-245 . . . . . **$4.60**

Delineation of drinking water source protection zones for Water System Canyon Spring, a public-water-supply spring, Iron County, Utah, by Charles E. Bishop, 35 p., 4/11, RI-246 . . . . . **$4.30**

Earthquake safety in Utah - a progress report for 2000 by the Utah Seismic Safety Commission, 69 p., 4/01

This report lists the accomplishments and activities over a four-year period to June, 2000. The USSC is charged by the Governor to assess and suggest better building codes relating to seismic safety, to champion the strengthening of existing buildings (especially public ones such as schools), and to lead in the collection and dissemination of geoscience information related to earthquake safety. . . . . . **Free**

Progress report: Geologic map of the east part of the Provo 30' x 60' quadrangle, Utah, year 1 of 3, compiled by James C. Coogan and Kurt N. Constenius, 10 p., 1 pl., scale 1:50,000, 2/01, OFR-379 . . . . . **$5.50**

Progress report: Geologic map of the Ogden 30 x 60 quadrangle, Utah and Wyoming, year 3 of 3, by James C. Coogan and Jon K. King, 30 p., 1 pl., 1:100,000, 2/01, OFR-380 . . . . . **$8.60**

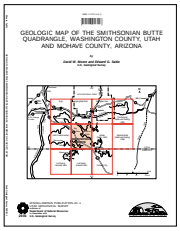
Utah! 100 years of exploration...and still the place to find oil and gas, 20 p., 5/01, ISBN 1-55791-655-1, PI 71

This colorful and very informative brochure is aimed at giving the oil and gas industry some appreciation of exploration and production possibilities in Utah. It is also quite informative to any reader interested in this aspect of the state's economy. **$2.00**

Interim geologic maps of the Clarkston and Portage quadrangles, Box Elder and Cache Counties, Utah, and Franklin and Oneida Counties, Idaho by Robert F. Biek, R.Q. Oaks, Jr., S.U. Janecke, B.J. Solomon, and L.M.S. Berry, 91 p., 2 pl., scale 1:24,000, 4/01, OFR-381 . **$15.00**

Interim geologic map of the Chriss Canyon quadrangle, Juab and Sanpete Counties, Utah, by Malcolm P. Weiss, J.G. McDermott, D.A. Sprinkel, R.L. Banks, and R.F. Biek, 67 p., 1 pl., scale 1:24,000, 5/01, OFR-383 . . . **$9.50**

Geologic map of the Smithsonian Butte quadrangle, Washington County, Utah and Mohave County, Arizona, by David W. Moore and Edward G. Sable, 30 p., 2 pl., scale 1:24,000, 6/01, ISBN 1 55791-651-9, MP-01-1



The quadrangle sits on the Arizona border just south of Springdale, Utah and Zion National Park. This study by U.S. Geological Survey staff includes several measured sections. **$10.95**

Interim geologic maps of the Crandall Canyon and Hidden Lake quadrangles, Summit County, Utah, by Michael D, Bradley, 41 p., 6 pl., scale 1:24,000, 5/01, OFR-382 . . . . . **$18.00**

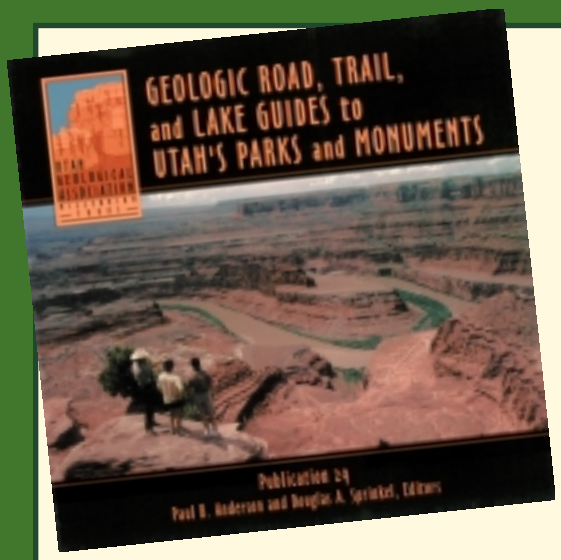
The geology of the Snyderville basin, western Summit County, Utah, and its relation to ground-water conditions, by Francis X. Ashland, Charles E. Bishop, Mike Lowe, and Bea H. Mayes, 59 p., 15 pl., scale 1:48,000, 6/01, ISBN 1-55791-652-7, WRB-28

The Snyderville basin includes Park City, Snyderville, and several ski/recreation resorts that have been experiencing rapid growth during the past two decades. Water has always been a concern and will continue to be a major economic factor. The initial study, completed in 1996, has been revised for this publication.. . . . . **$19.95**

Proceedings of the 35th Forum on the Geology of Industrial Minerals - The Intermountain West Forum 1999, edited by Roger L. Bon, Richard F. Riordan, Bryce T. Tripp, and Stanley T. Krukowski, 286 p., ISBN 1-55791-654-3, MP-01-2

This proceedings volume has 23 papers, 6 concerning other countries' industrial minerals, and the remainder having to do with the history, development, impact, or future of the industry in the Intermountain West. Also included are the abstracts and presentations given at the conference held May 2-7, 1999 in Salt Lake City, Utah. **$29.95**

Geologic map of the Moab and eastern part of the San Rafael desert 30' x 60' quadrangles, Grand and Emery Counties, Utah, and Mesa County, Colorado, by Hellmut H. Doelling, 3 pl., scale 1:100,000, Map 180 *This map actually covers all of the south half of Grand County, home of the Paradox oil field, Arches National Park, and Deadhorse Point State Park. The mapping has taken over a decade to complete and represents a significant contibution to understanding the geology of the entire southeast quadrant of Utah.* **$36.50**



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Paul B. Anderson, Editor
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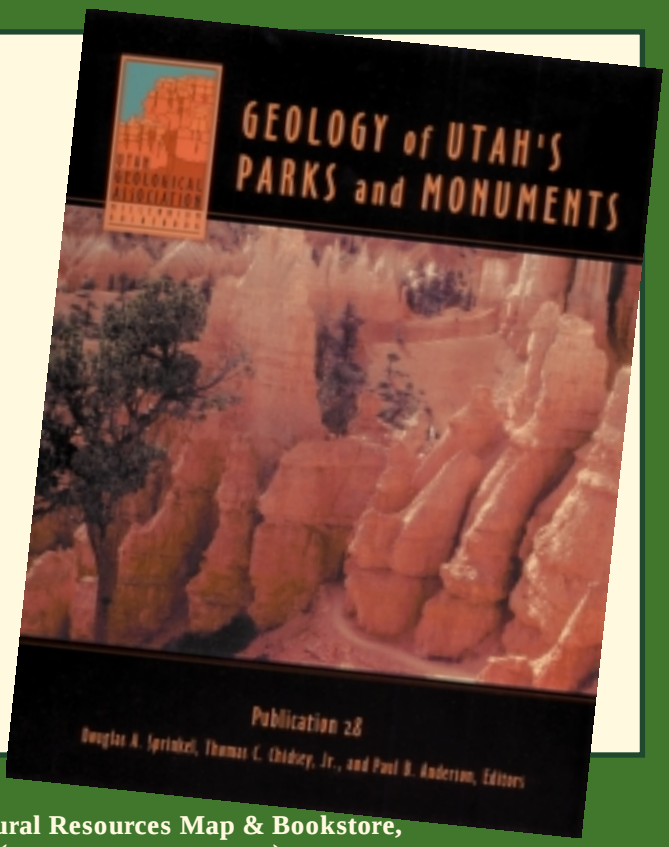

These products and more are available at the Natural Resources Map & Bookstore, 1594 West North Temple, Salt Lake City (www.maps.state.ut.us).

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