UTAH GEOLOGICAL AND MINERALOGICAL SURVEY

QUARTERLY REVIEW

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Project Utah "Explodes" Recovery

by Howard R. Ritzma,
Petroleum Geologist, UGMS

Utah Geological Survey geologists have observed operations conducted by Western Oil Shale Corporation at WOSCO No. 1-Ex, Project Utah, an experimenal core hole drilled eight miles southeast of Ouray, Uintah County.

Project Utah is proposed to test feasibility of creating a cavity or "chimney" in oil shale by the explosion of a small nuclear device. The shale would then be ignited and the "chimney" used as an underground retort for oil production.

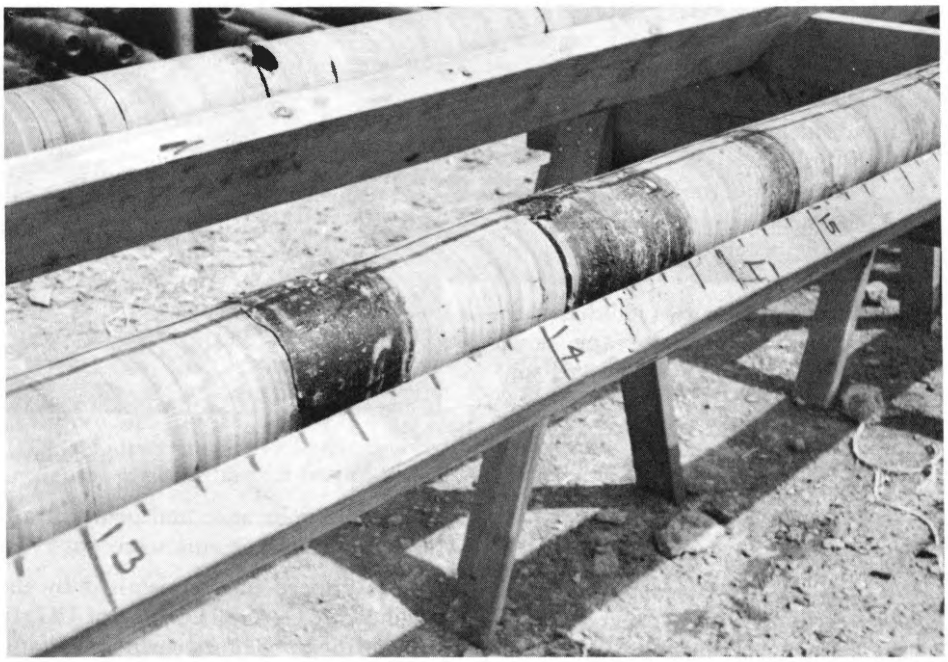
Coring completed July 31 was the first phase of site evaluation. About 1,200 feet of core were cut and recovered to provide a complete columnar cross section of the Green River Formation oil shales in what is thought to be the thickest, richest deposits in the Uinta Basin.

Cores were marked, boxed and shipped to the U.S. Bureau of Mines, Laramie, Wyoming, for description and a foot-by-foot assay of oil content.

The No. 1-Ex core hole was extensively logged by a wide variety of mechanical logs — electrical, sonic and radioactive — and subjected to careful hydrologic tests.

Results of the assays, mechanical logs and hydrologic tests expected to be complete in 2 or 3 months will determine whether the site is suitable for a nuclear test.

Total depth of the core hole was 3,245 feet. If the site is determined suitable from all scientific, technical and safety aspects, the nuclear device might be detonated as early as late 1970 or 1971. Depth of the explosion is expected to be about 3,000 feet below ground.



Cores recovered from WOSCO No. 1 – Ex core hole racked up prior to boxing and shipment. Banded oil shale makes up most of core with occasional streaks of dark oil-saturated nahcolite (hydrous sodium carbonate). Most bands of saline minerals encountered were oil-saturated and many oozed or bled thick gilsonite-like oil.

Project Utah contemplates operations for the present on a considerably reduced pilot scale.

The No. 1-Ex "chimney" would create about one million tons of shale rubble containing about 600,000 barrels of oil. As much as half of this could be consumed in the underground retorting process with the other half recovered as gaseous and liquid oil at the surface.

On a larger scale the process might recover tens of millions of barrels of oil per square mile.

The underground retort process eliminates expensive mining and handling of shale, construction and maintenance of surface retort facilities and problems of disposal of spent shale, a troublesome talcum powder-like nuisance for which no use is known.

Project Utah is the direct successor to Project Bronco which was planned on Federally - controlled lands in the Piceance Creek Basin of northwest Colorado.

The Utah program is on State of Utah lands leased to Western Oil Shale Corporation.

Success of the experiment may some day yield very sizable royalty income to Utah's beleaguered treasury.

The Utah Geological Survey's sample and core library is to receive a quarter of the full core for permanent record and study.

Corpsmen Remove Mudslide

by Bruce N. Kaliser,
Engineering Geologist, UGMS

Corpsmen from the Weber Basin Civilian Conservation Center volunteered their assistance after the mudslide which came through the rear of a house in Uintah, Weber County, on June 6. The slide occurred in the cut in the hillside above the house.

The horizontal Lake Bonneville silts and very fine sand beds comprising the hill were saturated, largely by irrigation and effluent from the septic tank of the house above.

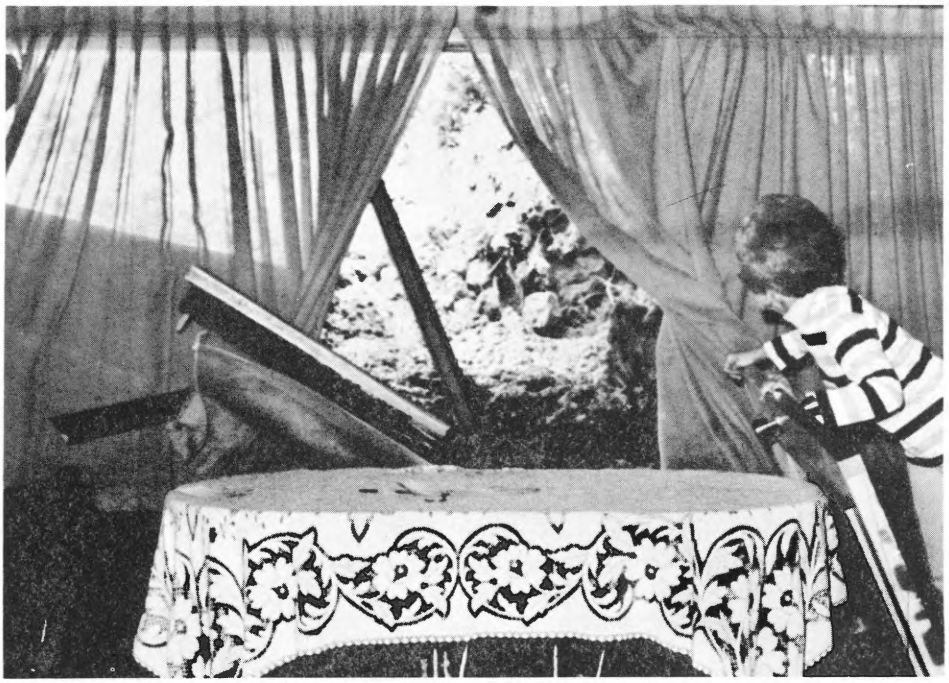
The residence was damaged when the mud pushed the wall in. A hundred men cleared only the mud from the house, leaving the remainder intact so as not to remove the entire toe of the slide.

A woman and her two children narrowly escaped as the slide came down on the sundeck where they were sunning themselves.

The Center where the corpsmen are stationed is situated at the mouth of Weber Canyon, along the Wasatch Front. Many of the buildings lie in juxtaposition to the Wasatch Fault.

Officials at the Center undertook some excavation with a backhoe to explore the fault in unconsolidated materials. A 25-foot-long trench averaging seven feet in depth was dug by the corpsmen.

The slope wash material in which the trench was dug was homogeneous in overall appearance and poorly stratified. No displacements were observed.



Slide invades dining room.

This undertaking, supervised by the Engineering Geology Division of UGMS is in furtherance of its earthquake fault research program.

In May of this year, a mudflow swept across much of the Center from the mountains on the east. This was the result of a fill failure.

Uninvited mud is removed by Job Corpsmen following a second slide which occurred two hours after the first.

Leakage from the aqueduct within the fill provided the water leading to the failure and subsequent mudflow that had all the characteristics of those frequently resulting from cloudburst floods along the Wasatch Front.

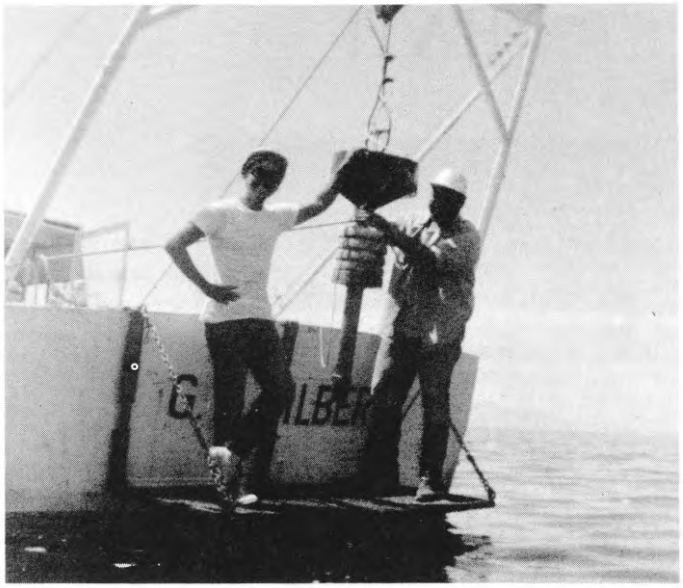
Subsurface conditions unsuitable for drainage of sewage effluent have offered a further problem for the corpsmen at their Center. The filter field has failed and extensive site exploration has been conducted to find a suitable new field.

The Utah Geological Survey inspected an extensive network of newly excavated trenches at the request of the Davis County Health Office.

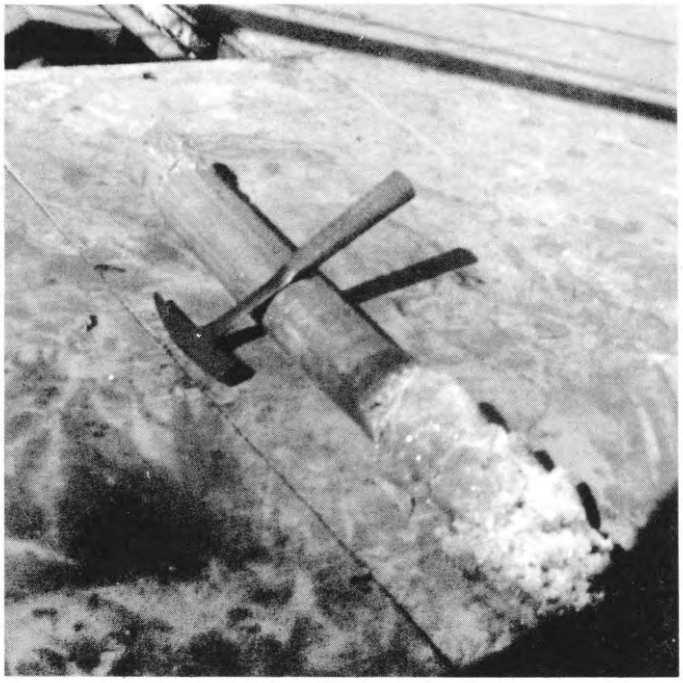
The material down to the greatest depth explored is all derived from old mudflows and it is relatively tight and impervious. This necessitates 6,500 linear feet of trench to service this one small camp.

The Weber Basin Job Corps Center has had its share of engineering geology-related problems. Their involvement well outside their immediate needs has been extensive.

The corpsmen might well finish their tours having acquired a greater practical knowledge of engineering geology than is offered in a formal course.



Boat crew prepares to core salt crust in Great Salt Lake.



Great Salt Lake core showing a 29-cm section of salt crystals.

DROP CORER TESTED

by Leonard L. Hedberg,
Staff Specialist,
Great Salt Lake Research, UGMS

The Utah Geological Survey is testing a new coring device in Great Salt Lake. The apparatus, a hydroplastic drop corer, used by the U.S. Navy in oceanographic studies, was shipped to Utah from Florida. The corer is aiding research on sedimentary environments on Great Salt Lake.

Using the hydroplastic sampler, 45 cores, up to 10 feet long, have been taken in depths of 12-30 feet of water. Reef bodies, extensive mud horizons and salt zones have been cored.

One of the most interesting finds of the coring program has been the salt crystals forming in deep troughs of the south arm of the Great Salt Lake. The salt appears to be mostly NaCl, but detailed tests have yet to be made.

Researchers have been aware of salt depositing in the north arm of the lake as the brine becomes supersaturated with certain mineral constituents during the summer months.

A salt crust in the midlake region of the south arm, however, had never previously been observed.

This salt layer has measured up to 29 cm in thickness near the Southern Pacific Causeway. South, at the same water depth, the crust thins and then thickens again within a long narrow trough.

It is believed that the south arm salt deposits may be related to a dense low-lying brine covering much the same area.

The dense brine has an abrupt interface with typical Great Salt Lake brine at approximately 24 feet (August 1969). Salt crystals have been observed in depths greater than 25 feet of water.

Through additional research the Utah Geological Survey will learn more about the origin, behavior and occurrence of Great Salt Lake saline deposits.

Committee Councils on Hazards

The Geologic Hazards Committee for Utah was officially appointed by executive order of Governor Calvin L. Rampton in July. The Committee has been in existence and has functioned in an unofficial capacity since March 1967.

The Committee will act in an advisory capacity to the State Department of Natural Resources.

This department is the result of a reorganization in 1968 to consolidate administration of the State Engineer's office, Water and Power Board, Fish and Game Division, Parks and Recreation Division, Land Board, Oil and Gas Conservation Commission, and Forestry Division.

The advice and information provided by the Committee is available to agencies not under the control of the department. In particular, it is the hope of the Hazards Committee that county and municipal government councils and agencies will make use of the committee's services.

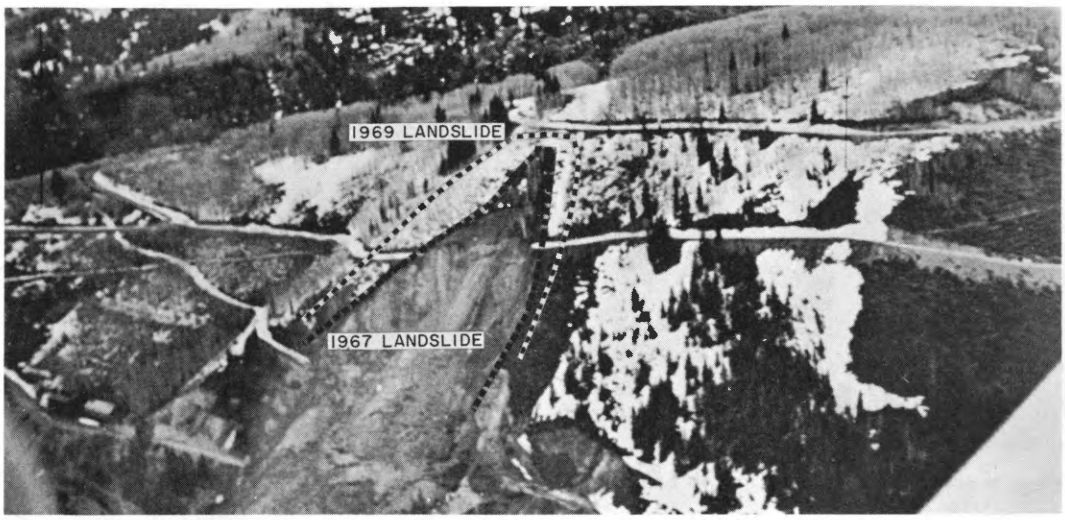
The hazards of earthquakes, floods, landslides, poor foundation materials, subsidence, mudrock flows and excavation wall failures, inherent in our environment, probably most closely effect these governments as their communities are threatened or endangered.

The disciplines of geology, geophysics, structural, civil and soils engineering, and architecture are represented among the 13 committee members.

The most successful educational activity of the committee, the Governor's Conference on Geologic Hazards, was held for two days in December 1967. Participants from throughout the state heard papers given by out-of-state and local professionals.

Clifford Bryner of the University of Utah Civil Engineering Department is committee chairman and Bruce N. Kaliser, engineering geologist of UGMS, is secretary.

SLIDES DO JUST THAT!



Dashed lines indicate further slide encroachment in May 1969 compared to original May 1967 slide.

Almost exactly two years ago in May, a landslide came cascading down the side of Empire Canyon in Park City, Utah.

On May 12 of this year a second slide carried with it approximately four times the amount of debris of the May 24, 1967 slide (see *Quarterly Review,* vol. 1, no. 13, page 1, August 1967).

The second slide created a hazard that was narrowly avoided in the first occurrence. The toe dammed Empire Canyon and formed a lake behind it. The water depth exceeded 30 feet in this lake, covering a power substation.

The toe came within 75 yards of a large two-story house and only just missed burying a car with two occupants.

Since the occurrence of the second slide, a channel has gradually been cut, draining the reservoir with no damage to the terrain below. The house near the toe of the slide has been moved.

Overall view of slide, 1969.

Slide debris extending across canyon; lake forming upstream.

Longitudinal view showing debris dam and backed up water at foot of slide. Large compacted snow and ice boulders from higher elevations in foreground (see story, opposite page).

Lake Powell Effects Study

During June 15-28 an NSF-sponsored field conference was held at Flagstaff, Arizona, to discuss what may well develop into a multimillion dollar interdisciplinary research project centered on Utah's Lake Powell.

Participants came from ten institutions and from the fields of geology, geophysics, meteorology, plant and animal ecology, archeology and sociology. Utah was represented by Dr. Ralph T. Shuey of the University of Utah's Department of Geological and Geophysical Sciences.

The conference, hosted by Dr. V. J. Schaefer of the State University of New York at Albany, was the outgrowth of a proposal submitted early this year to the Ford Foundation by Orson L. Anderson, professor of mineralogy at Columbia University.

This proposal was for an integrated geological - geophysical - botanical - meteorological study of the environmental changes produced by Lake Powell, and ultimately of the social and political consequences of these changes.

The ultimate structure of the research project is currently the subject of active negotiation.

Some of the more interesting observations made at the field conference concerned the effect of the lake on the Navajo Sandstone in which it rests.

Lake water moves out easily into the highly permeable Navajo, leaching out the calcite cement as it percolates.

In the galleries cut back into the Navajo Sandstone near the dam a steady spray of water emerges at the rate of 1,500 gallons per minute.

Stalactites are growing from the walls, and the leached sandstone there can be crumbled in the hand like packed sand.

One of the first questions to be considered by the Lake Powell research project will be the fate of the water disappearing into the canyon walls.

According to the Bureau of Reclamation, the total percolation from the lake as of October 1967 was 3,000,000 acre-feet. Is this average rate of 800,000 acre-feet/year temporary or permanent? Can and will the Navajo tribe use the 400,000 acre-feet/year possibly coming onto their reservation?

The Tribe currently takes about 500,000 acre-feet yearly from the San Juan near Shiprock, New Mexico.

A vital legal point is that the water to be delivered at Lees Ferry for Arizona and California is fixed by the Colorado River Compact at around 7 million acre-feet/year, so that any permanent flow into the banks of Lake Powell might mean just that much less water for Utah.

Acknowledgments

The UGMS acknowledges with thanks and appreciation the help of Magnesium Project in compiling UGMS analyses on computer cards. The cards record Great Salt Lake brine analyses made by the UGMS during the course of its field investigation in 1968.

For help in furthering our Great Salt Lake programs, thanks are extended to Morton Salt Company for their contribution to the UGMS of $1,000.00 for equipment to be used by the UGMS for research and development of the Great Salt Lake, and to Kennecott Copper Corporation for purchasing interpretations of magnetic data which will be obtained from Great Salt Lake surveys in August and September.

Place Names Official

Three new official place names have been approved by the Department of the Interior Board on Geographic Names.

All were suggested by the UGMS and stem from mapping of oil-impregnated sandstone deposits in southeast Utah.

In the Circle Cliffs, Garfield County, a mesa located 3.5 miles west - southwest of Wagon Box Mesa has been named Bitumen Mesa for the abundant outcrops of oil- (or bitumen-) impregnated sandstone found on all sides and beneath the mesa.

Northwest of Cataract Canyon in northeast Garfield County, Tar Cliff and Fault Point have been approved as names of prominent topographic features along the south extension of the Orange Cliffs in the Cove area.

Both names have been used previously by the UGMS for oil-impregnated sandstone deposits within the large area called the "Tar Sand Triangle," a gigantic group of interconnected deposits among the Dirty Devil, Colorado and Green rivers.

The Department of Interior designations are as follows:

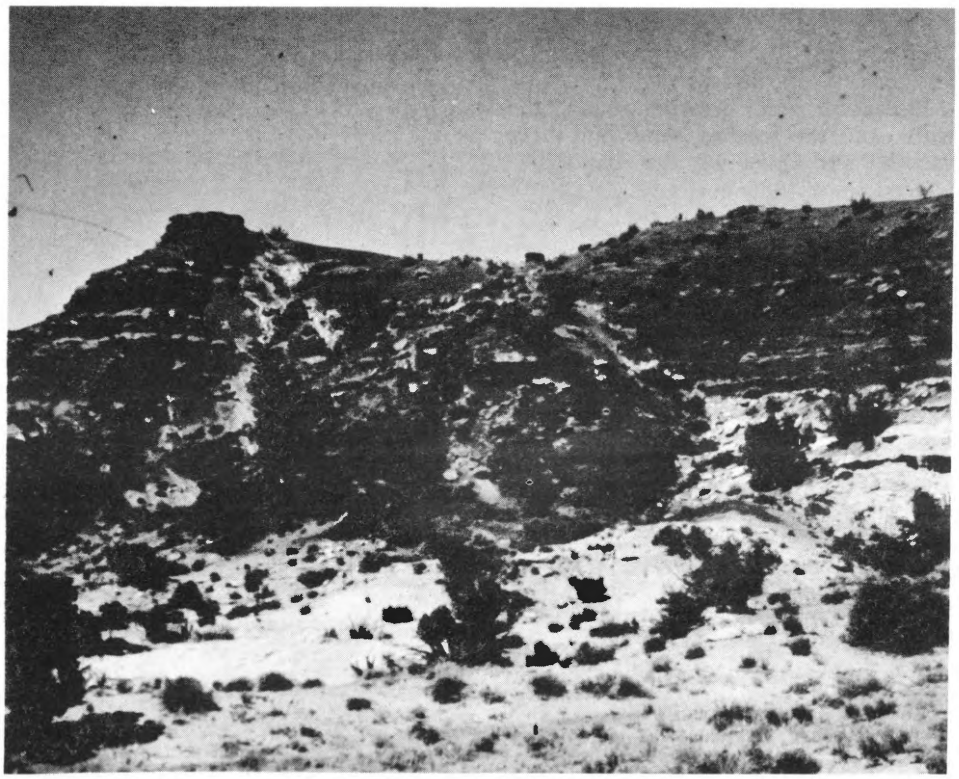
Decision List 6902

Bitumen Mesa: mesa, highest elevation 6,501 feet, trends N-S 1.1 miles, 3 miles WSW of Wagon Box Mesa; Garfield County, Utah; 37°48′00″ N, 111°08′20″ W.

Decision List 6903

Fault Point: point of land, 2.8 miles SW of Tar Cliff and 2 miles NW of the junction of Cove Canyon and Cataract Canyon in Lake Powell; Garfield County, Utah; 37°57′50″ N, 110°14′10″ W.

Tar Cliff: cliff, 0.6 miles long, S facing, just S of Red Point and 3 miles N of the junction of Cove Canyon and Cataract Canyon in Lake Powell; Garfield County, Utah; 37°59′10″ N, 110°11′40″ W (center).



Fault Point from southeast. Light-colored Cedar Mesa sandstone is displaced 100 feet up on right against dark red Organ Rock shale. Oil-saturated Cedar Mesa sandstone which crops out for three miles northeast of this fault constitutes the Fault Point oil-impregnated sandstone deposit (UGMS Map 25).

STAFF CHANGES

Mrs. Bernice Y. Smith, long-time secretary at the University of Utah, has resigned her position.

Mrs. Smith, who since 1961 was secretary of the Department of Geology, held the same position in the Department of Geological and Geophysical Sciences when it was organized in July 1968.

She was also technical editor for the Utah Geological and Mineralogical Survey, and for a time was the Geology Museum attendant until it closed in January 1969.

Mrs. Smith and her husband Hugh, who received his Ph.D in geology at the University of Utah in August 1969, have gone to Roanoke, Virginia, where Dr. Smith will teach geology and geography at Virginia Western Community College.

Mrs. Bertha H. Barton, for the past 13 months secretary to Director William P. Hewitt of the Utah Geological and Mineralogical Survey, has resigned her position to accompany her husband. They and their small son have left Utah for Milwaukee, Wisconsin, where Mr. Barton will be employed.

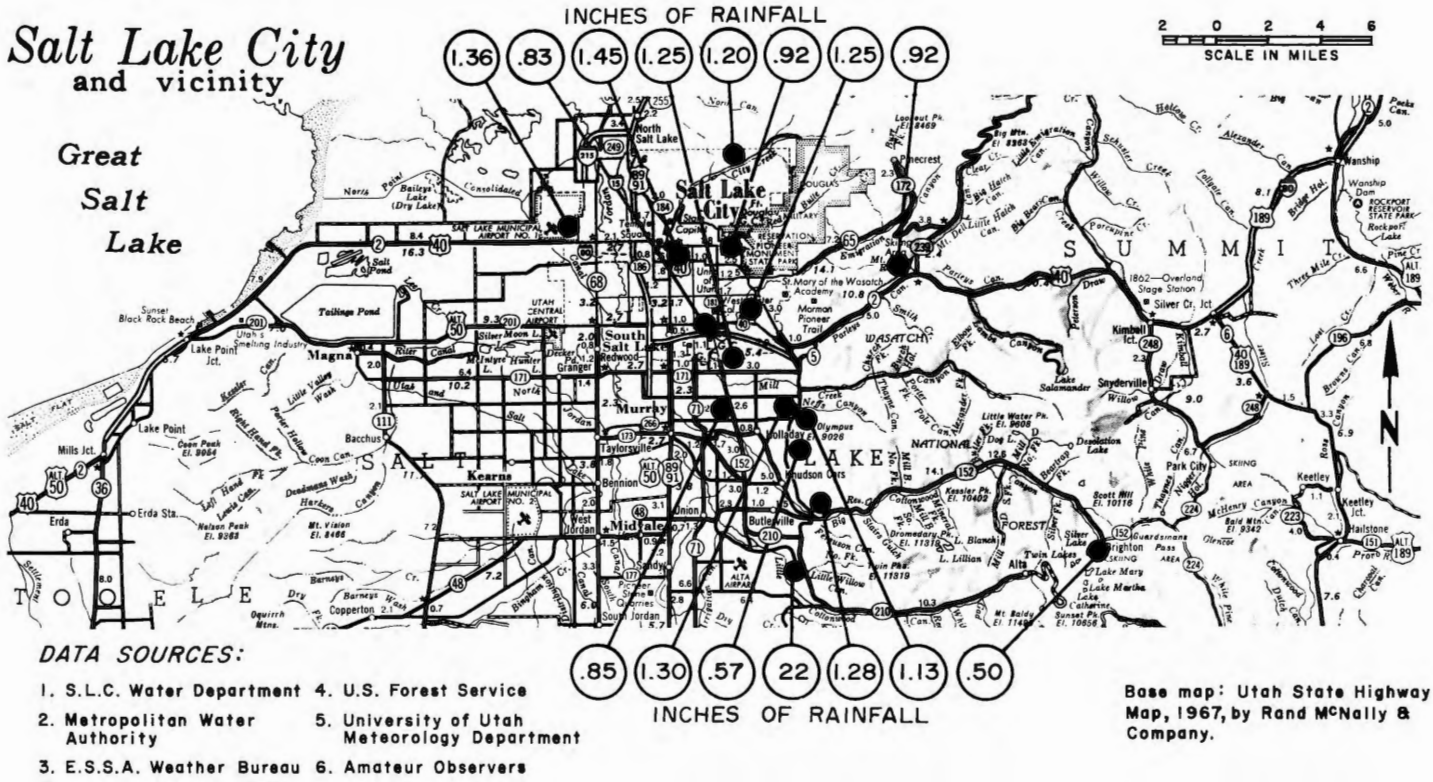
Mrs. Barton's position has been filled by Mrs. Jacquelyn L. McCormick.

SAMPLES ADDED

More than ten tons of boxed and packaged oil well samples from hundreds of wells in Utah, Nevada and western Colorado have been received from Pan American Petroleum Corporation, Denver, Colorado, and Farmington, New Mexico.

The enormous piles of boxes, without doubt the weightiest contribution ever made to the Survey's collection, is being sorted through to cull out duplication of well samples already in the library.

It is hoped that the new samples can be cataloged and made ready for public use by September or October.



Cloudbursts Inundate Valley

A large portion of the state, indeed the country is subject to cloudburst-type precipitation.

These short duration high-intensity storms are difficult to predict and are spotty in occurrence. They are influenced greatly by local topographic relief.

We have plotted here precipitation records for one such storm that occurred in the evening of July 29.

Small areas in Salt Lake City experienced precipitation at different times between 6:30 p.m. and 9:30 p.m. Most of the rainfall recorded at any one spot probably fell during a period of from 15 minutes to one hour.

The local scene in Salt Lake City in places was one of uncontrolled inundation in which buildings and cars were flooded.

Surface runoff along the flanks of the mountains has been increased in recent years by the spread of paving and construction. Streets take on the appearance of river beds, fills become entrenched with fresh ravines, and debris piles up at breaks in slope such as subdivision backyards.

From here to there, from higher to lower—sediment is moved a bit farther along as much or more so in these short bursts as during more uniform periods of precipitation — for rainfall is but another geologic force at work.

There has recently been made available a set of 12 maps of the state at a scale of 16 miles to the inch; each map depicting isopluvials for a different precipitation period and frequency.

A glance at any of the maps shows the areas of the state most susceptible to cloudburst activity.

These maps were prepared by the ESSA Weather Bureau for the Soil Conservation Service Engineering Division. One set remains on open file at the Engineering Geology Division of the UGMS.

PUBLICATION RELEASED

FOCUS ON FLOOD HAZARDS

The Utah Geological Survey is pleased to note the issuance of Technical Publication No. 21 of the Utah Department of Natural Resources, Division of Water Rights, entitled, "Summary of Maximum Discharges in Utah Streams."

Study of this publication by engineers and planners should aid in reducing the effect of flood hazards upon the works of man in Utah.

The flood magnitude and frequency data contained in the publication should enable engineers to prepare designs with the proper margin of safety for peak flows. Planners should, of course, avail themselves of these data for flood zoning purposes.

There is no longer any excuse for putting business, industrial and residential structures in areas subject to intermittent inundation.

It has always been imperative that hydraulic structures be designed to cope with maximum discharges. Any guesswork that can be eliminated from the hydrologic evaluation should be very welcome indeed to the engineers.

This publication is written by G. L. Whitaker, U.S. Geological Survey and is available from 442 State Capitol, Salt Lake City.

NOTICE: As a new correspondent of the Smithsonian Institution's Center for Short-lived Phenomena, the Engineering Geology Division of UGMS solicits information on new geological events within the state.

The center maintains a file on world occurrences of earthquakes, landslides, volcanic eruptions, fossil finds, meteorites, fireballs, ground subsidence and related events. Institutions, agencies and individuals are invited to consult the reports on short-lived events that will be continuously deposited with the Survey.

TOPOGRAPHIC MAPS ISSUED — USGS

The following is a list of new Utah topographic maps issued by USGS since July 1, 1968.

Alton
Bald Knoll
Billies Mtn.
Bull Rush Peak
Bull Valley Gorge
Bryce Canyon
Chester
Circleville
Co-op Creek
Danish Knoll
Deer Spring Point
Elisabeth Mtn.
Explorer Peak
Fairview Lakes
George Mtn.
Golden Spike Monument
Granger Mtn.
Jerico
Joes Valley Reservoir
Junction
Kidney Lake
Lake Ridge
Mill Fork
Mt. Lovenia
Oweep Creek
Podunk Creek
Rainbow Point
Rays Valley
Salina
Skutumpah Creek
South Tent Mtn.
Spring City
Sterling
Strawberry Res. NE
Strawberry Res. NW
Tropic Canyon
Water Hollow Ridge
Wilson Peak
Yogo Creek

These maps are 7½" scale and available at the USGS office in the Federal Building in Salt Lake City for 50¢ each.

Plateau Scenes

Believing that visitors to the "different land of Utah" should understand more about its geology, Professor William L. Stokes has written *Scenes of the Plateau Lands and How They Came to Be.*

In this 66-page booklet Dr. Stokes gives a simplified explanation of how rocks react to erosion to produce cliffs, mesas, buttes, canyons, monuments, bridges and other natural scenic features.

There are short chapters on petrified forests, dinosaur graveyards, extinct volcanoes, badlands, sand dunes and cliff dwellings, all emphasizing the time element and the fact that landscapes evolve and change under the slow but endless influences of weathering and erosion.

The text is illustrated by numerous sketches by the author.

The booklet is for sale at most of the National Park visitors' centers in the state, and at the Utah Geological and Mineralogical Survey; the price is $1.00, plus 25¢ postage for all orders by mail.

DINOSAURS MONUMENTED

A new publication on the Dinosaur National Monument will be released in the next few weeks.

Written by G. E. and B. R. Untermann, long-time ranger naturalists in the Monument and only recently retired, the "Popular Guide to the Geology of the Dinosaur National Monument" is sponsored by the Dinosaur Nature Association.

Visitors to the Monument will find the new publication for sale there, and copies will be available from the Dinosaur Nature Association, Jensen, Utah 84035. The price was not determined at press time.

QUARTERLY REVIEW

State of Utah .....*Calvin L. Rampton Governor*
University of Utah .....*James C. Fletcher President*
College of Mines & Mineral Industries .....*George R. Hill Dean*
Utah Geological & Mineralogical Survey .....*William P. Hewitt Director*

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On Open File

The Utah Geological Survey has on open file a USGS map of the south half of the Fort Douglas quadrangle.

The file consists of the map, a sheet of symbols and their explanations, and several pages of descriptions of the geologic features.

The map covers the area from the City Creek filtration plant south to the Pioneer Monument, and from 600 East five miles to the east.

The area is of interest in light of urban attrition in the area and the presence of landslide deposits, colluvium, aeolian sand and artificial fill.

All of these deposits are potentially or demonstrably unstable and subject to cave-ins, landslides and flash-flood damage.

This map will be of particular value to city officials concerned with development and safety and to builders and residents in the area.

The following items also have been placed on open file by the USGS. Copies may be seen at the Utah Geological Survey office.

1. Preliminary geologic map of the Death Ridge quadrangle, Garfield and Kane counties, Utah, by H. D. Zeller.
2. Oil shale in the Green River Formation, by U.S. Geological Survey.

Material placed on open file may be reproduced; the cost of such reproduction to be assumed by the individual.

The USGS has at its office Circular 623, "Gold-bearing Jasperoid in the Drum Mountains, Juab and Millard Counties, Utah," by J. H. McCarthy, Jr., and others. This report describe anomalous concentrations of gold in jasperoid outcrops.

This report is available at 8102 Federal Office Building, Salt Lake City, Utah 84111.