UTAH GEOLOGICAL & MINERAL SURVEY

QUARTERLY REVIEW

Vol. 9, No. 4 Service to the State of Utah November 1975

National Meetings in Salt Lake City

Geologists and mining engineers descended on Salt Lake City by the thousands in September and October as the Society of Mining Engineers held its fall meeting September 10-12 and as the Geological Society of America convened October 20-22. Both groups held their meetings at the new convention facilities at the Salt Palace.

It was the first time in history (since 1888) that the Geological Society of America had held its national meeting in Salt Lake City. Joining with GSA were its affiliated societies: Paleontological Society, Society of Economic Géologists, Mineralogical Society of America, Geoscience Information Society, Geochemical Society, and the National Association of Geology Teachers. About 3,000 persons registered and participated in the conferences, symposia, and field trips.

Hellmut H. Doelling, UGMS chief of economic geology section, presented a paper on the Emery coal field. Bruce N. Kaliser, UGMS chief of urban and engineering geology section, presented a paper on the ground cracks resulting from the March 27, 1975, Pocatello Valley earthquake. Howard R. Ritzma, UGMS assistant director, was chairman of the fifteen field trips conducted before, during, and after the meeting. Doelling, Kaliser, Ritzma, Jock A. Campbell, UGMS chief of petroleum geology section, and J. Wallace Gwynn, UGMS chief of research section, directed several of the field trips.

Another important but smaller meeting was the GSA Penrose Conference on the Regional Geophysics and Tectonics of the Intermountain West held on September 21-26 at Alta, Utah.

Manti Canyon Landslide

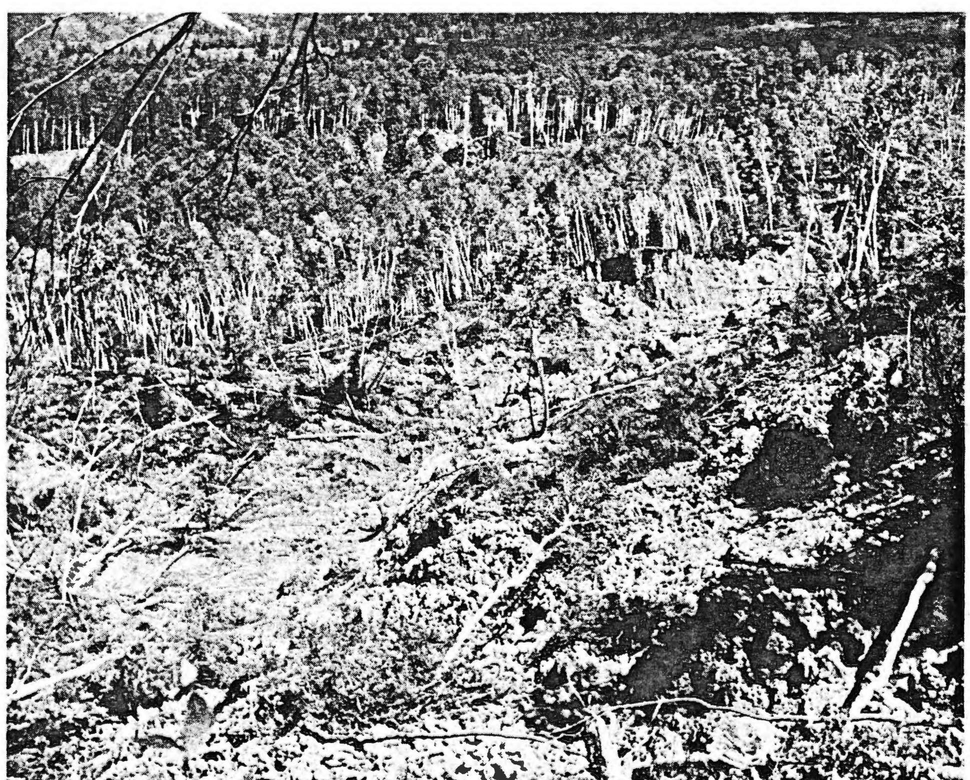
Town Prepares for the Worst

The city of Manti has its landslide problems. In May 1974 the city's culinary water supply was cut off by earth movement in Manti Canyon. Now, this same unstable ground continues to move.

The landslide is on the south side of Manti Canyon, four miles upstream from the city of Manti (population 1,800). Bruce N. Kaliser, chief of the urban and engineering geology section at the Utah Geological and Mineral Survey, estimates the 2 mile long and 3/4 mile wide (at the toe) mass to contain over 33 million cubic yards of earth material. This entire prehistoric landslide has been rejuvenated as a result of the ground movement in May of last year (see *Quarterly Review*, Vol. 8, No. 3, August 1974).

The buttress for this moving mass is nothing more substantial than another prehistoric landslide on the north side of the canyon—its presently inactive toe being eroded now by the northward-shifting channel of Manti Creek. The toe of the active south side does not move as a coherent mass but rather at different rates along its length. In the last few

(continued on page 5)



Subsidiary slide in foreground is moving towards (to the left) the major landslide (uplifted area in center of photo). Both east and west lateral fractures that bound the earth movement are visible as lines of disturbed trees (August 1975). *(UGMS photo)*

Survey Releases Latest Studies

The Utah Geological and Mineral Survey has released its latest publications through the UGMS Publication Sales Office, 104 UGS Building, University of Utah, Salt Lake City, Utah 84112. When ordering by mail, add 10% for handling and mailing charges–minimum charge is $.25.

Bulletin 107, *Geology and Mineral Resources of Garfield County, Utah*, by Hellmut H. Doelling ($6.50). This is one of a series of county studies in preparation by UGMS. Bulletin 107 combines a compilation of all published geologic work on the region with a wealth of original mapping and previously unpublished data collected by the author over more than ten years. Bulletin 107 contains 133 photographs and illustrations, 40 tables, and a geologic map of the county.

Utah Geology, *Vol. 2, No. 2, Fall, 1975*. Published biannually. Subscriptions are $6.00 per year. Single issues are $3.50. Reprints of any article are $1.50 each. Handling and mailing charges are included in the subscription price. This issue contains the following articles: "Depression Structures in Unconsolidated Sediments of Great Salt Lake, Utah," by Alan G. Seelos, John D. Oldroyd, and Douglas R. Allen; "Currents of Great Salt Lake, Utah," by W. M. Katzenberger and J. A. Whelan; "Geology of the Roosevelt Hot Springs Area, Beaver County, Utah," by Carol A. Petersen; "Sedimentary Cycles in the Nugget Sandstone, Northeastern Utah," by Lee R. High, Jr. and M. Dane Picard; "A Comparison of Models for Flow Through the Causeway, Great Salt Lake, Utah," by J. A. Whelan and Carol A. Petersen; "Structural Geology and Petroleum Potential of the South Flank of the Uinta Mountain Uplift, Northeastern Utah," by Jock A. Campbell; "New Magnetic Declination Values for Utah," by Howard R. Ritzma; "Earthquake Epicenters in Utah July-December 1974," by Kenneth L. Cook; and "Bibliography of Utah Geology 1974."

Roosevelt Hot Springs . . .

Geothermal Area Looks Promising

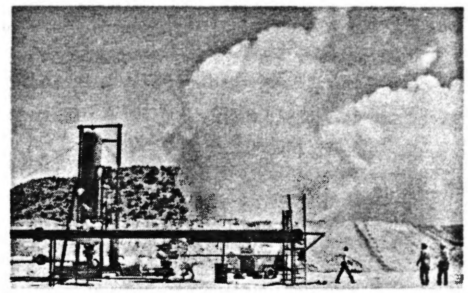
Geothermal steam may be used to generate electrical power in Beaver County in a few years. Phillips Petroleum Company has tested two geothermal wells in the Roosevelt Hot Springs area this summer, and the wells show commercial potential.

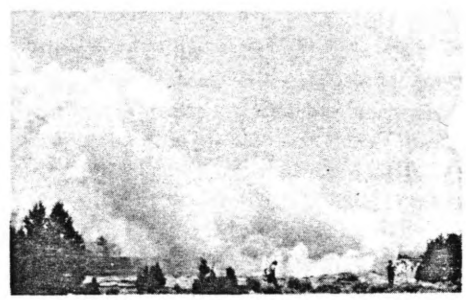
One well, in NW¼SE¼ sec. 3, T. 27 S., R. 9 W., blew out on April 29, 1975. Later testing of this well showed mass flow rates of more than 200,000 pounds per hour at temperatures greater than 400°F. The well was 2,728 feet deep.

A second well in this same section was drilled to a depth of 2,882 feet. A twenty-four hour flow test through a steam-water separator showed that the well could produce 250,000 pounds per hour of steam. By comparison, an average commercial steam well in The Geysers field in California produces 150,000 pounds per hour of steam when first put into service. The Geysers is the only geothermal field in the United States presently producing steam to generate electricity.

Phillips Petroleum reports the Roosevelt geothermal reservoir to be "liquid dominated" and to contain high pressure hot water that is considerably less saline than sea water. The low salinity makes disposal of used water a less severe problem than that experienced in other liquid dominated reservoirs. Phillips Petroleum leased much of the land in the Roosevelt Known Geothermal Resource Area by competitive bid from the U. S. Bureau of Land Management in July 1974.

A description of the geology of the Roosevelt Hot Springs area will appear in the Fall, 1975, issue of *Utah Geology*, Vol. 2, No. 2.





Top: Expansion loop (horizontal pipe) leads from the well head to a steam-water separator (left side of photo). Clouds of water vapor in background are rising from a holding pond. *Bottom:* Rising clouds of water vapor shortly after hot water and steam are released from the separator in the holding pond. *(photos courtesy of the Beaver County News, Milford, Utah)*

AN "H" OF A MESS - UINTA(H)

The spelling of Uinta versus Uintah arises in newspapers, magazines, and publications of all types. With the important new energy developments in the Uinta(h) basin, the word is appearing all over the world with and without the "h" on the end and sometimes (regrettably) mispelled "Unita" even on the prestigious pages of the *Oil and Gas Journal, World Oil,* and the *New York Times*.

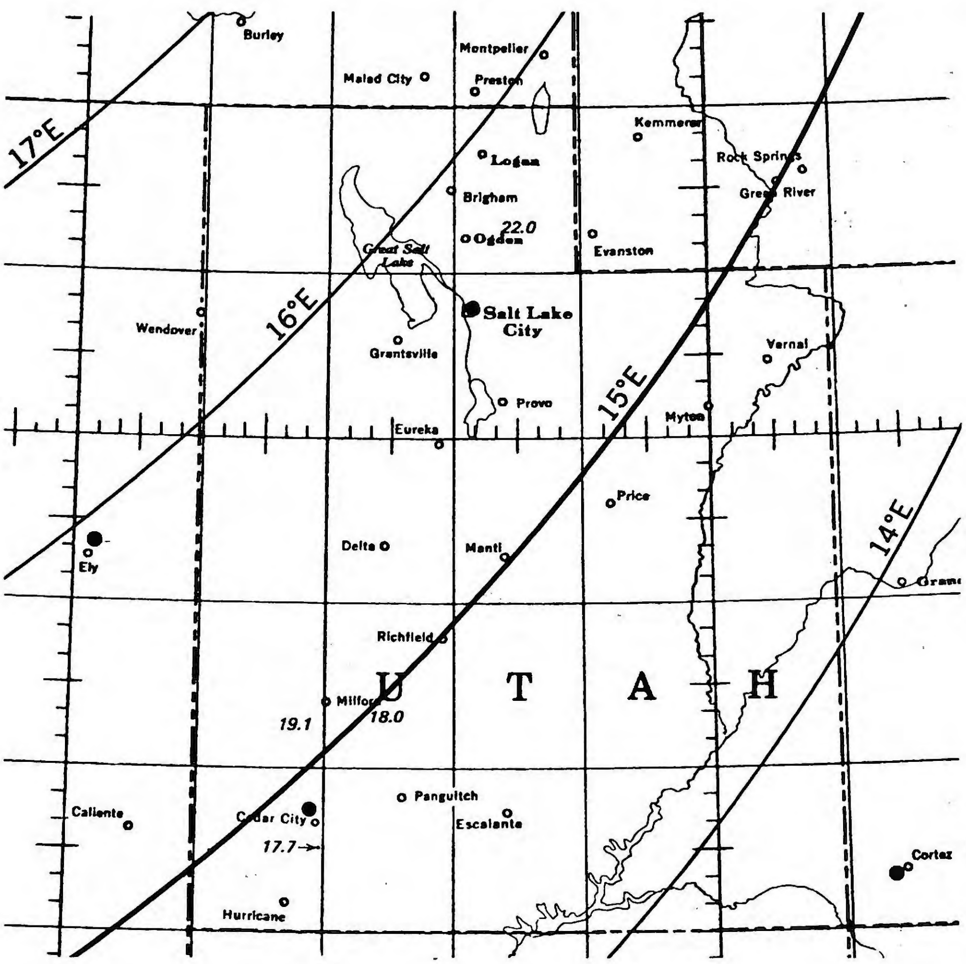
Standard usage by the U. S. Geological Survey and the U. S. Department of the Interior Board on Geographic Names has led to this rule of thumb (of course, with exceptions): If it's a natural feature, it's Uinta–Uinta Mountains, Uinta River, Uinta fault, Uinta basin, Uinta Creek, Uinta Gulch, and Uinta Park. If it's something man-made, it's Uintah–Uintah County, Uintah and Ouray Indian Reservation, Uintah (town in Weber County), and Uintah gas field. The exceptions are the Uinta Pipeline, headquartered in Denver, and the Uinta Base Line and Meridian on which the township and range grid is based in the Uinta basin.

There is a Hewinta Guard Station in the National Forest in Summit County, Utah, and a Uinta County, Wyoming, but the less said about them the better.

Which way is north?

Utah's Changing Magnetic Field

Earth's constantly changing magnetic field affects the angle between true and magnetic or compass north. For those who do geologic field work or conduct surveys based on compass readings, the map shows the adjustment necessary for the declination or variation from true north as determined for January 1, 1975. This value ranges from 13 degrees 30 minutes east of north at the southeast corner of the state to 16 degrees 45 minutes at the northwest corner. Abnormal measured values are shown in the Cedar City, Milford, and east Ogden vicinities.



Over the years, the declination in Salt Lake City has varied as follows (all east of north):

Year	Declination east[1]
1900	16°53′
1905	17° 6′
1910	17°22′
1915	17°32′
1920	17°33′
1925	17°23′
1930	17°15′
1935	17°14′
1940	17° 8′
1945	16°58′
1950	16°45′
1955	16°34′
1960	16°26′
1965	16°15′
1970	15°59′
1975	15°38′

[1] In degrees and minute of arc. Values for intervening years may be found by interpolation. (Table prepared by Solid Earth Data Services Division, NGSDC, EDS, NOAA.)

The north end of the compass needle is moving westward at Salt Lake City at a rate of about 4.25 minutes annually following a trend that began about 1920.

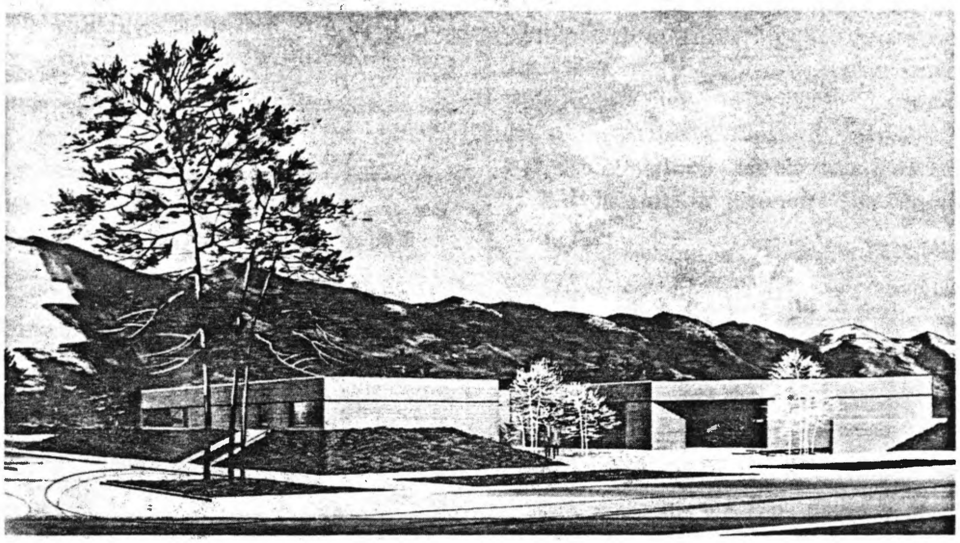
For more comprehensive coverage of the conterminous 48 states, Alaska, and Hawaii, U. S. Geological Survey Map I-911, prepared by the Branch of Theoretical and Applied Geophysics, may be consulted or purchased at the U. S. Geological Survey Public Inquiries Office, Federal Building, Salt Lake City.

ROCKY RIDGES

by Greg McLaughlin

MOVING SOON . . .

New Home for Geological Survey



We will be moving soon. The Utah Geological and Mineral Survey has signed a ten-year lease with Boyer-Gardner Research Park Partnership on its new home, now under construction.

The building will contain 16,000 square feet of space that has been designed to our needs. Located on a 1.6 acre plot at the intersection of Arapeen Drive and Blackhawk Way in the Research Park addition of the University of Utah, the new facility will provide adequate space for our operation and easy access and ample parking for visitors.

We are looking forward to occupancy around the first of the year.

Specialist Appointed

Carlton H. Stowe, UGMS Information Specialist, has been named to the Bureau of Land Management Utah State Advisory Board. The appointment was made by Paul L. Howard, BLM state director for Utah. Twelve persons were selected by the state director and confirmed by the U. S. Department of the Interior.

The state advisory board was organized in accordance with the Federal Advisory Committee Act passed by Congress in 1972. The Utah board is part of a trilevel (national, state, and district) system of BLM advisory groups. The board provides the BLM state director with administrative recommendations for the multiple use of the national resource lands.

WORDS TO THE WISE

In his paper in the August 1975, *Geological Society of America Bulletin* (v. 86, no. 8, p. 1056), Clarence R. Allen of the Seismological Laboratory of the California Institute of Technology stated that "the most important single contribution to gaining a better understanding of long-term seismicity, which is critical to the siting and design of safe structures and to the establishment of realistic building codes, is to learn more, region by region, of the late Quaternary history of deformation, and particularly that of the Holocene epoch. More specifically, I see a special need for geomorphological studies in these regions, better and more radiometric dates, and accurate detailed geological field mapping that utilizes trenches and boreholes as well as surface exposures. Studies of these kinds, in my opinion, offer the best hope of inferring what has happened during earthquakes within the very recent geologic past, and therefore what is likely to happen again in the near future."

Water Levels of Great Salt Lake

Lake levels recorded (in feet above sea level) since the high mark set on June 15 are (U. S. Geological Survey readings):

Date	Boat harbor (south arm)	Saline (north arm)
June 15	4,201.55	4,199.10[1]
July 1	4,201.45	4,199.10
July 15	4,201.45	4,199.15
August 1	4,201.15	4,199.10
August 15	4,200.80	4,199.05
September 1	4,200.45	4,198.85
September 15	4,200.20	4,198.75
October 1	4,199.95	4,198.65
October 15	4,199.90	4,198.60

[1] Corrected from the 4,199.15 foot level reported in the *Quarterly Review*, Vol. 9, No. 3, August 1975.

On October 15, 1975, the south arm was 0.75 foot higher than it was on the same date in 1974.

Dr. Doelling Promoted

Dr. Hellmut H. Doelling, chief of economic geology section at the Utah Geological and Mineral Survey, has been promoted to the newly created rating of Geologist 29. Dr. Doelling, whose first association with UGMS was in 1955 wh[illegible] a student at the University of Utah, is a leading authority on coal deposits in Utah and in the intermountain states. At present, he supervises the largest of UGMS' geologic sections.

MANTI SLIDE

continued from page 1)

weeks the rates of movement have reversed, so that the eastern part of the toe is moving faster than the western.

The slide may eventually block the canyon and the stream running through it. Such a dam could be a flood hazard for the city as the stream would back up behind an unengineered embankment that could subsequently fail. At present the flow of Manti Creek is 20 cubic feet a second. A flow of 10 to 20 times greater is anticipated next spring.

At the request of Governor Rampton, a field investigative team was organized in August, 1975, to study the problem. The team, consisting of civil engineers, hydrologists, geologists, and flood disaster specialists, spent three days at the slide during the first week in September. They studied the impact the slide would have on natural features such as the canyon slopes and on man-made ones such as the road, aqueduct, and power plants in the canyon. They concerned themselves with finding ways to alleviate slide and flood danger now and in the future. Mostly, they sought immediate, practical solutions to the problem.

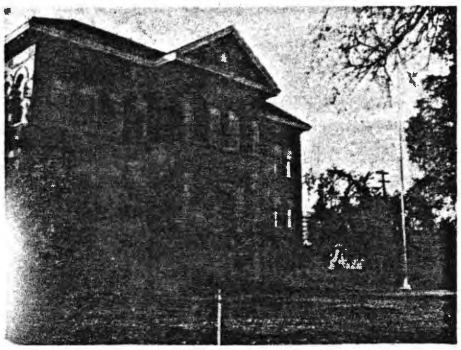
In an effort to protect Manti from possible flooding, should the worse come to be, the investigative team instigated flood control measures. The Utah National Guard has begun to clean the two debris basins at the mouth of Manti Canyon. The city is clearing flood channels in town and placing sandbags around all low spots. The U. S. Forest Service has begun clearing the channel of Manti Creek upstream from the debris basins. In addition, the U. S. Forest Service is to use earth moving equipment to keep the encroaching toe of the slide from changing the course of Manti Creek, but as yet they have not started the work.

In the meantime Kaliser, one of the organizers and a member of the field investigative team, continues to monitor and study the phenomenon.

Top: En echelon fracturing of earth embankment of Cottonwood Dam affected by sliding (August 1975). *Bottom:* Installation of continuous recording extensometer across eastern boundary fracture near point where Manti aqueduct was severed in 1974. End of wire is attached to a pole driven into uplifted pressure ridge (August 1975). *(UGMS photos)* *(continued on page 6)*

Quake Victim

School Revisited



Despite drilling of test borings and digging of test pits on the grounds of the old Sumner School in Salt Lake City by the Utah Geological and Mineral Survey, no conclusive reason can be given for the vere damage caused during the March , 1975, Pocatello Valley earthquake. ccording to Bruce N. Kaliser, chief of GMS' urban and engineering geology ction, the ground beneath the building xperienced anomalously strong motion.

The structure, which was originally built in 1892 with three subsequent additions, was inspected by Kaliser. What he found in the interior—wrenched and strained windows and doors, deformed door hinges, wall mounts of radiators torn loose, and wall and ceiling cracks—indicated that the subsurface conditions around the school should be examined to learn why this one spot proved so suscep-ible to earth shaking, and at this distance om a moderate earthquake (magnitude 0) epicenter. Salt Lake City's Depart-ent of Housing Services consulted GMS initially for guidance on how to treat the problem.

Since the building was not being used as a school at the time of the quake, Kaliser recommended that the city establish a life and property risk factor that would be acceptable for other types of occupancy. Although the building is no longer suitable for the high occupancy rate of a school, it might be considered for much lower occupancy functions. In this case the building could be considered as a storage facility. According to Kaliser older municipal buildings under these ircumstances could be structurally odified or restricted by occupancy to eet the city's needs, without the pense of condemnation and new con-truction. But whatever the recommenda-tions, the future of the old Sumner School must rest with the decision of the city commission.

MANTI SLIDE

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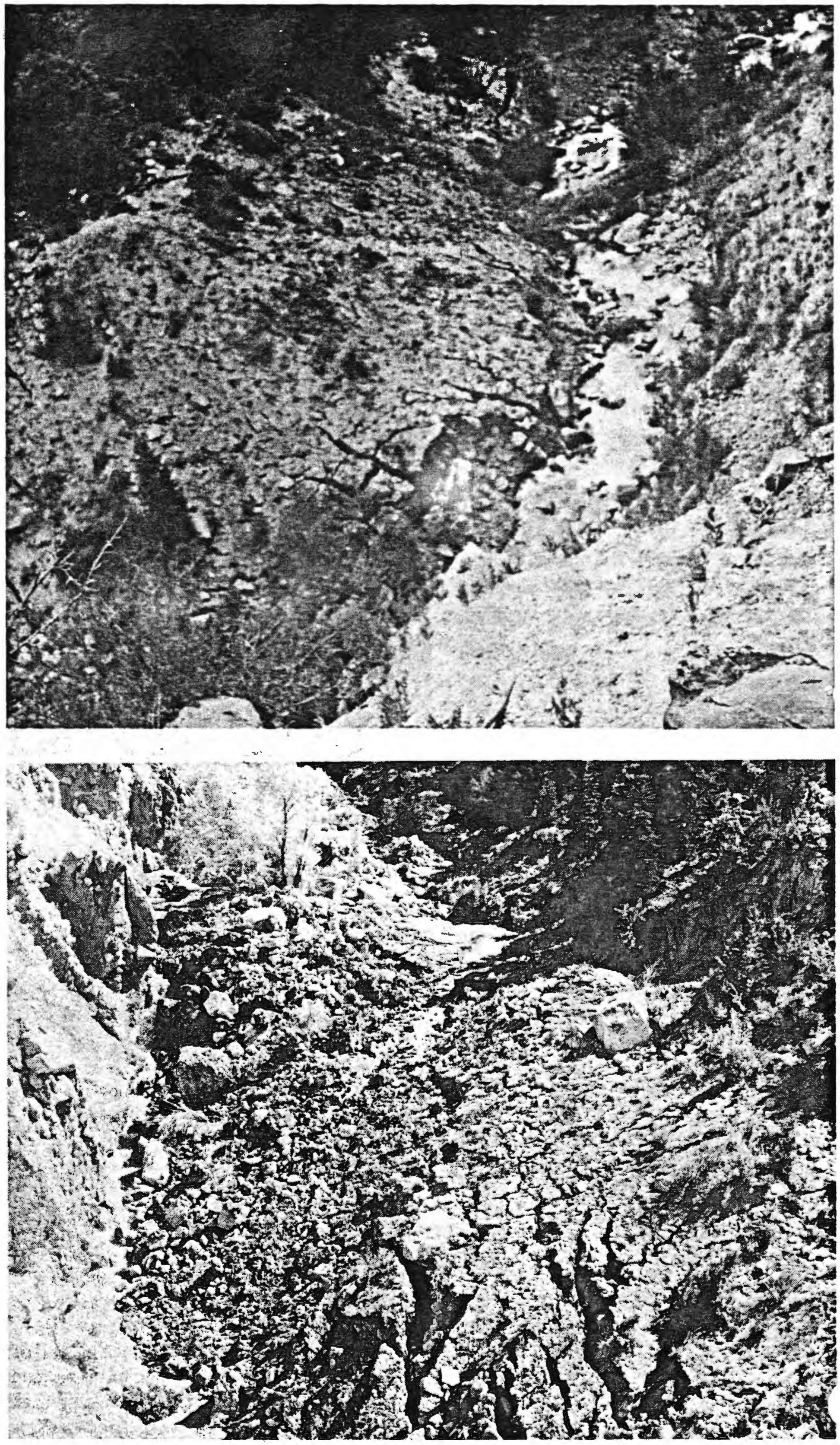

Top: Fracturing of western part of toe of Manti landslide (August 1975). Manti Creek is cutting against north slope (right side of photo) of channel. *Bottom:* Advanced stage of encroachment of the western part of landslide toe on channel of Manti Creek (September 1975). Note 30-foot uplift of channel (in left center) has caused steep rapids in the stream. *(UGMS photos)* *(continued on page 7)*

What's it worth?

Mineral Value of the Great Salt Lake

What is the mineral value of the Great Salt Lake?

Placing a value on the minerals of the Great Salt Lake may be as hard as pricing the moon. We know a vast potential is there, but how or when will it be valuable. The appraisal depends greatly on the economics and technology of the time. It may be more reasonable then to look at the lake as a stable chemical resource, without getting into dollar and sense variables.

A brief examination of the chemistry of the lake will show that it is a large, complex system of water that contains numerous dissolved metallic and nonmetallic ions. The following table (data taken from the Utah Geological and Mineral Survey's Water-Resources Bulletin 20, *Great Salt Lake, Utah: Chemical and Physical Variations of the Brine, Water-Year 1973*, by J. A. Whelan and Carol A. Petersen) gives the relative amounts of the major elements and trace elements found within the lake as a percent of the dissolved salts:

Element	Weight (in percent)
chloride	55.50
sodium	30.62
sulfate	7.23
magnesium	3.88
potassium	2.54
calcium	0.15
bromine	0.05
boron	0.02
lithium	0.01

The total dissolved salt content of the lake has been estimated to be about 4 billion metric tons (over 4 billion short tons). The lake waters contain varying amounts of dissolved salts depending upon their location within the lake, as follows:

Location	Weight (in percent)	Grams per liter
South arm (less than 23 feet)	12.65	138.45
South arm (greater than 23 feet)	21.90	252.16
North arm (total)	27.33	331.87

At present five mineral commodities are being produced from the lake. These are sodium chloride, magnesium metal, chlorine, potassium sulfate, and sodium sulfate. In the future the mineral value of the Great Salt Lake will change even more as other commodities are extracted from its salts and brines. The following list of commodities that are or can be produced from the lake brines is not complete, but it shows the great and varied potential that exists: sodium chloride, sodium sulfate, sodium metal, potassium chloride, potassium sulfate, potassium metal, potassium hydroxide, sodium hydroxide, magnesium chloride, magnesium sulfate, magnesium metal, magnesium hydroxide and oxide, mixed salts of magnesium-potassium-chloride-sulfate, lithium, bromine and boron compounds, hydrochloric acid, chlorine, calcium chloride, and calcium sulfate.

The mineral value of the Great Salt Lake today or tomorrow does depend upon the commodities that are or will be produced. Quantity, grade, quality, market economics, and technology serve only to complicate the answer to "What is the mineral value of the Great Salt Lake?"

MANTI SLIDE
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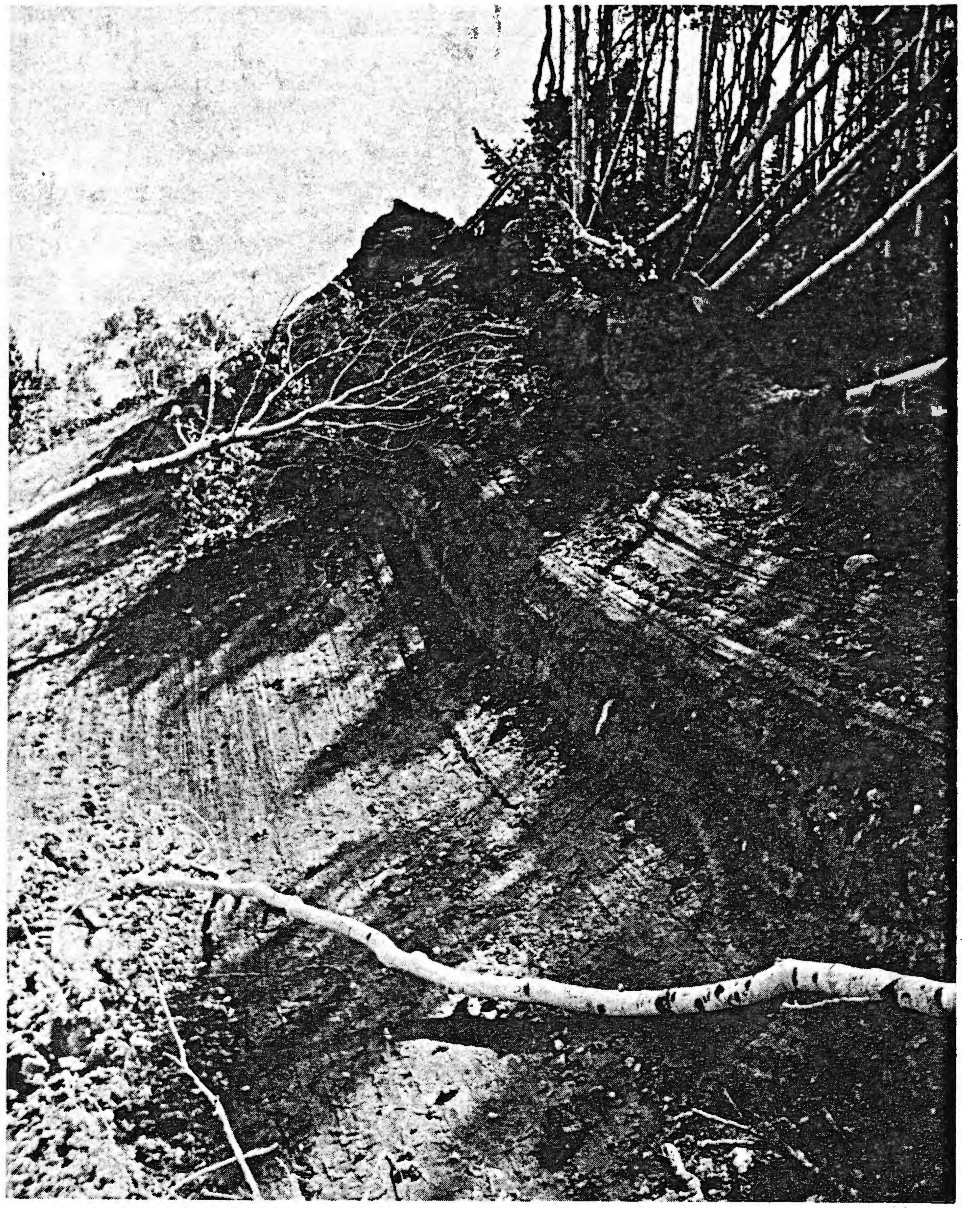

Surface on which the landslide has moved is exposed along western boundary. Note striations and undulations that indicate largely lateral movement (August 1975). *(UGMS photo)* *(continued on page 8)*

MANTI SLIDE

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Interference of creeping thrust sheets on eastern part of toe of landslide (September 1975). *(UGMS photo)*

UTAH GEOLOGICAL AND MINERAL SURVEY
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