

SEE NO EVIL...

## Wasatch Fault — A Potential Hazard — Disregarded

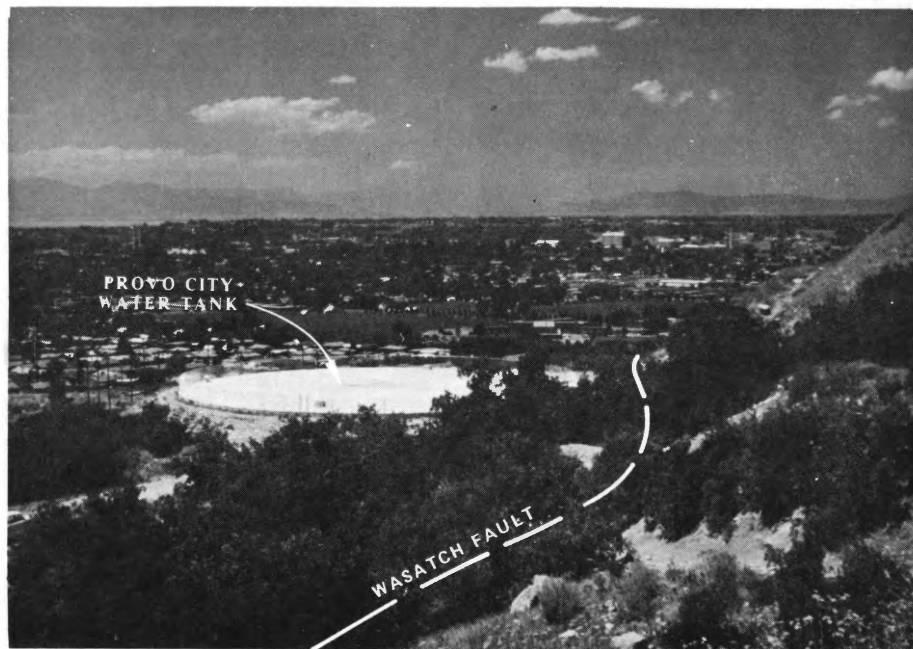
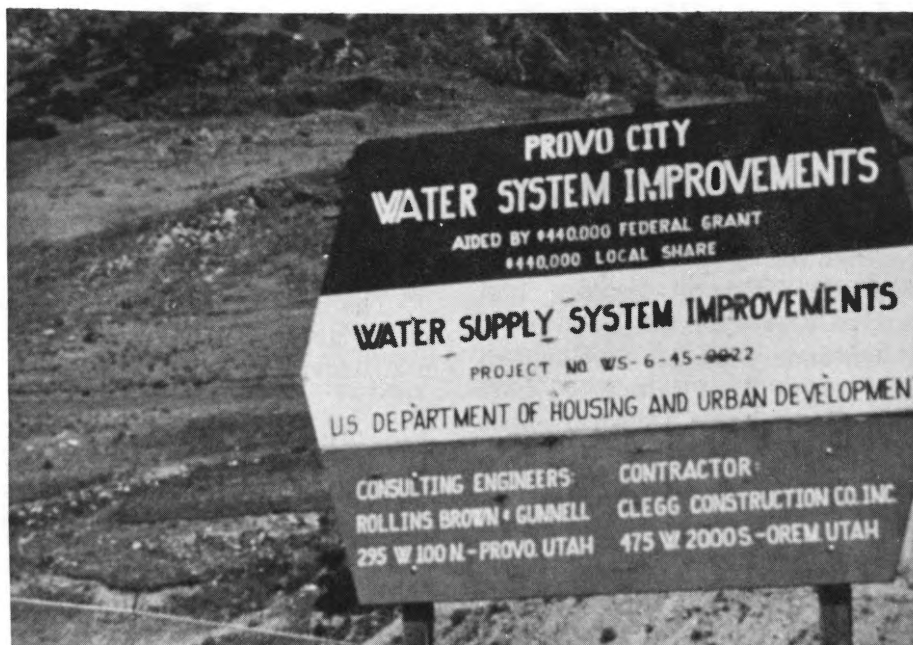
The Wasatch fault system is one of the nation's most active tectonic belts with demonstrated seismicity. Fortunately no major destructive events have occurred in Utah's 125-year history.

In many cases, however, water facilities and other major engineering works span or are constructed in immediate proximity to recent traces along the Wasatch fault in metropolitan areas along the Wasatch front where some 85 per cent of Utah's population reside.

The Utah Geological Survey is active in publicizing the hazard and in educating all levels and entities of government of the situation. But its voice goes largely unheard; the photographs (right) depict merely one example where, in this case, a Federal government agency, with apparent disregard to a potentially serious geologic hazard, has funded a local construction project.

The prominent fault scarp is relatively recent. Should the downthrown block on which the water tank lies move, the tank would be subjected to displacement, damage and spilling or flooding of structures downslope in this well developed area.

This portion of Utah lies in seismic zone 3, that is, in an area of greatest expectancy of earthquake damage (National Oceanic and Atmospheric Administration designation, U. S. Dept. of Commerce).



Water facility in relation to active Wasatch fault, Provo City, Utah. Photos by Woodward-Lundgren and Associates.



Pennsylvanian Geological Survey library; photo files in background.



Salvaging and junking operations. Photo shows visible oil sludge.

## "AGNES" FLOODS PA.

### *Survey Faces Grim Loss and Clean-up*

In a disaster unparalleled in the experience of state surveys, tropical storm Agnes flooded the Pennsylvania Geological Survey demolishing its physical plant, totalling its library and mashing up its records.

On June 24, after four days of rain, the Susquehanna River reached a crest of 16½ feet above the flood stage at Harrisburg. The Survey, occupying the entire ground floor and basement at its new quarters, saw the water reach 12 feet at its site, well above the ground-floor ceilings.

The library of nearly 40,000 volumes was covered with dissolved glue, mud and industrial oil. Plywood walls lay in contorted shapes and plasterboard partitions sagged to the floor.

The staff salvaged a few instruments and fished out top-priority manuscripts for washing and drying.

Cleaning-up has begun, but starting over—a monumental task for a state-funded organization, let alone private individuals who must face the loss themselves—will take time.

duct fluids rapidly and may make exceptional aquifers to provide entire communities with water. Unfortunately, such formations conduct fluid waste effluents equally well.

In the zone of aeration above the water table, aerobic bacteria degrade the waste matter and chemical adsorption and ion exchange processes reduce pollutants that reach the water table. Below the water table in the zone of saturation, aerobic biodegradation largely ceases and anaerobic activity takes over. Biodegradable detergents and other contaminants are not degraded once they enter the groundwater where little oxygen is available.

In some localities, such as along the shoreline of Bear Lake in north Utah<sup>1</sup>, small closely spaced lots each have an independent water supply and sewage system. Water mostly comes from shallow aquifers. Horizontally bedded strata permit lateral migration of fluid effluent into the lake. The resulting addition of nutrients (nitrates and phosphates) to the surface water stimulates plant growth and contributes to algal bloom. Well sorted beach sands and gravels around the lake shoreline do not permit filtration, adsorption or ion exchange during the rapid subsurface migration of the fluid effluents.

In other mountain subdivisions a gravel-like material may contain sufficient clay to inhibit fluid conduction. Because of its inability to absorb and transmit fluid effluent from lateral drainage lines of the sewage system, this material is unacceptable for disposal systems.

With minimal exploration, geologists can reconstruct the subsurface environment sufficiently to preserve the *quality* of its most valuable resource, groundwater.

## At Home With Geology

by B. N. Kaliser  
UGMS Engineering Geologist

This is the first in a series of articles by Kaliser to report geologic problems and their possible solutions in subdivisions.

Wastes percolating through the soil to the water table, frequently caused by installation of septic tank and filter fields without adequate knowledge of subsurface geologic conditions, is the major source of groundwater pollution. Future shortages of quality groundwater could be averted if initial precautions are observed.

An exploration program for individual home-waste disposal systems consists of one or more

test pits on the lot, determination of depth to the water table and location of nearest water wells, springs and systems on adjacent lots. If the bedrock is shallow, its depth also must be determined. Slope of the ground surface, dip of geologic strata, profile of the bedrock surface and other structural features are also factors.

Fluid effluent from a sewage disposal system is filtered according to size of the earth materials (sand and gravel, uniform sand or pure clay), soil moisture content, depth to the water table and organic material.

Certain types of bedrock, mainly limestone and lava, con-

<sup>1</sup> See UGMS' Bulletin 96, "Environmental geology of Bear Lake area, Utah," by B. N. Kaliser.

## Recent Releases

Three new studies were released by UGMS in the last three months:

**Bulletin 96**, "Environmental Geology of Bear Lake Area, Rich County, Utah," by B. N. Kaliser (\$3.00), is intended to be a tool for planning in the Bear Lake area. Construction planners should consider drainage, slope, bearing strength, rippability, water table depth and fluctuation, flooding potential and suitable quantity and quality of water. The study presents detailed data on surface and subsurface aspects of the environment and contains interpretations of terrain and descriptions of specific localities of interest.

**Bulletin 98**, "Analysis of Gravity and Aeromagnetic Data, San Francisco Mountains and Vicinity, Southwestern Utah," by J. W. Schmoker (\$2.00). Geologic structures in the San Francisco Mountains vicinity of Beaver and Millard counties are described using aeromagnetic and gravimetric data. An interpretation of the regional geology of the area, based largely on geophysical data, is developed. The author concludes the study area is underlain by a large Tertiary intrusive pluton extending beyond the coverage of the aeromagnetic map to the east, south and west.

**Special Studies 40**, "Preliminary Report on Possible Solutions to 'Fill Effect' Causing Dilution of South Arm Brines and Concentration of North Arm Brines, Great Salt Lake, Utah," by J. A. Whelan and Norman Stauffer (\$1.50), details various methods for equalizing surface elevations and salinities of the two arms of the lake and lists estimated costs for each method. The study also discusses the effects of equalization on Great Salt Lake Mineral and Chemical Corp. operations.

(continued on page 6)

## DO NO EVIL...

# Untoward Risks in Altering Environ

Long-term regional and continental environmental hazards that could result from large-scale water developments often are glossed over, warns R. L. Mace, scientist of the U. S. Geological Survey, Department of the Interior.

Traditionally, planners and developers have given little thought to potential side effects and long-term ecological consequences of water manipulations... often, when they occur, [they] have come as surprises.

We have reached a point where our ability to interfere with and to change the environment far exceeds our ability to predict what the ultimate effects will be.

For example, earthquakes are triggered by dams and impounded water, land subsidence is caused by groundwater pumping and epidemics are spread by water-borne disease in irrigation projects.

Mace believes the proposed large-scale southward diversion of great rivers that now flow into the Arctic seas "would alter the existing heat, water and atmospheric vapor balances of the Arctic area and of the regions to which the

water would be diverted. Climates would be modified. The change in distribution of earth mass conceivably could affect the earth's rotation and precession of its axis of rotation, and while the relation of these to earthquakes is conjectural, a known cause of earthquakes is 'geostatic' loading by dams and impounded water."

Recognition of possible hazards, however, should not preclude development opportunities; the difficulty is to use opportunities in ways that will have rational, predictable outcomes.

Geology provides much needed perspective. If a citizen realizes that geologic hazards are natural phenomena and hazardous because man gets in their way, he can deal more knowledgeably and circumspectly with landslides and earthquakes.

Geologists' training makes them particularly qualified to understand the significance of alterations in the environment and, moreover, they have the unique knowledge necessary to deal with the risks involved.

## UGMS SERVES UTAH

The Utah Geological and Mineralogical Survey offices are located on the north side of the University of Utah campus (1st South and Wolcott Avenue), Salt Lake City.

The Survey is a State agency which investigates the geological and mineralogical resources of Utah and publicizes the results; research and geological environmental engineering are emphasized. Topographic and geologic maps, mineral resource and water studies, and geological and geophysical in-

vestigation publications are available over-the-counter or by mail.

A list of publications can be obtained free by writing Utah Geological and Mineralogical Survey, 103 UGMS Bldg., University of Utah, Salt Lake City, Utah 84112.



UGMS offices, University of Utah campus.



# Mineral Industry Expands in Southern Utah

by *Carlton Stowe*  
UGMS Staff Specialist

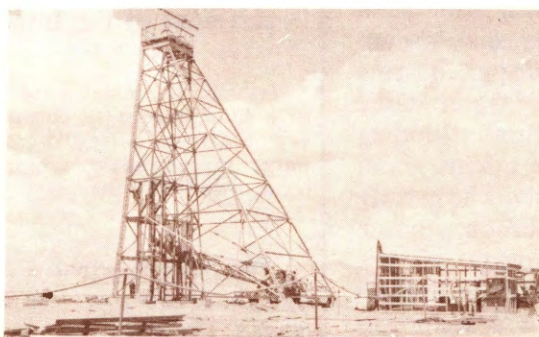
or Kennecott Copper's open-pit mine at Bingham.

Throughout southern Utah, however, several operations are influencing the development of Utah's mining industry:

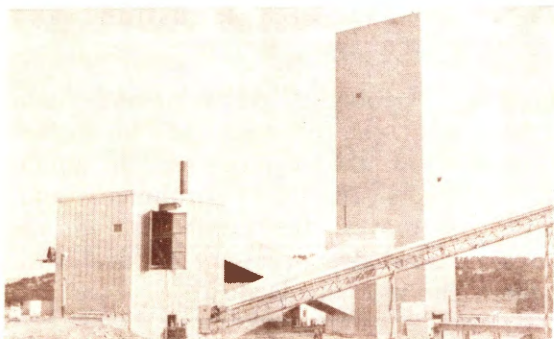
Utah's mineral industry is often equated with such giants as U. S. Steel's Geneva works



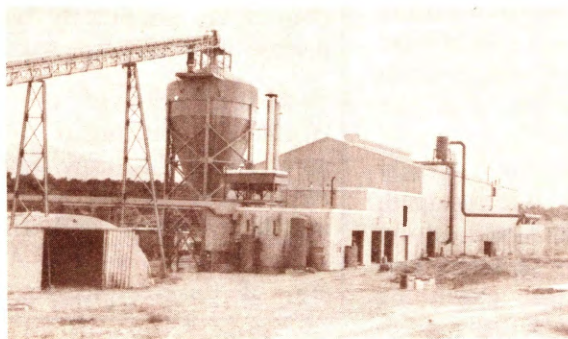
(1) *Atlas Minerals Corp.*'s uranium mill at Moab, Utah. In early 1973 *Atlas Minerals Corp.* expects to process 150 tons of uranium ore daily from its Snow mine facility, which is under construction about 13 miles west of Green River, T. 12 S., R. 14 E., Emery County (see adjacent photo).



Early stages of construction of shaft and surface facilities of the *Atlas Minerals Corp.* Snow mine facility. Centennial Development Co. constructed the two-compartment, timbered 640-foot deep shaft at the site in the Green River mining district. At least 30 employees will work at the mine.



(4) *Rio Algom Corp.*'s mine headframe facility and conveyor system. The new Lisbon Valley mill, about 45 miles southeast of Moab, began its first production of yellowcake in August. Deliveries of about 4.9 million pounds of uranium oxide in concentrate are to be delivered to Duke Power Co. of Charlotte, North Carolina, over the next seven years (see adjacent photo).

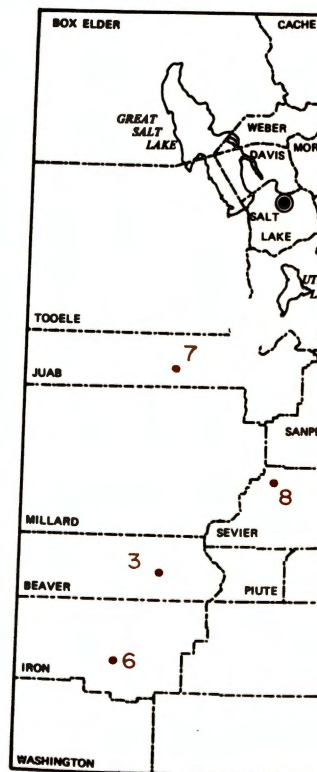
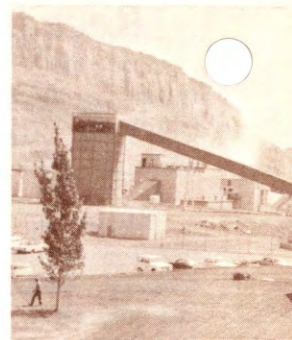
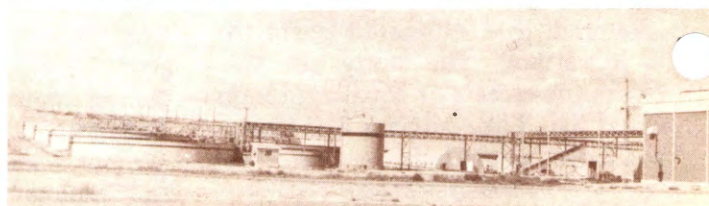


Uranium ore is conveyed from the crushers to the ore bins at the mill, *Rio Algom Corp.* The mine shaft, constructed by *Boyles Brothers Drilling*, is sunk to a depth of 2,600 feet. Uranium ore occurs below 2,550 feet in the Moss Back Member of the Chinle Formation. A 2,000-foot displacement occurs between the Chinle Formation at the *Rio Algom* site and its occurrence at the famous *Mi Vida* trend to the south.

(6) *Utah International, Inc.*'s stockpiled iron ore and conveyor belt at the Iron Springs district facility. The Iron Springs district is the largest iron-producing district in the western states. In 1971 approximately 291,000 tons of ore were produced. Ore bodies lie 12 to 20 miles west of Cedar City.



(7) *Brush Wellman, Inc.* Beryllium ores at Spor Mountain are being treated by hydrometallurgical processes at *Brush Wellman's* plant north of Delta. K. R. Poulson, mining division manager, announced the firm was developing a new open pit ore reserve 1½ miles southeast of its main pit at Spor Mountain in Juab County (see adjacent photo, right).







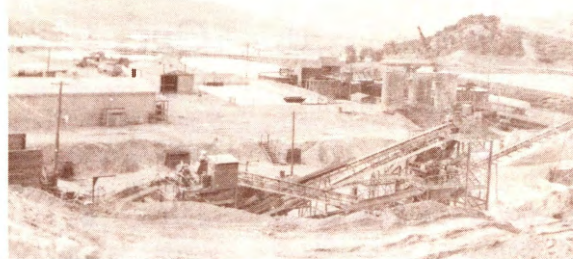
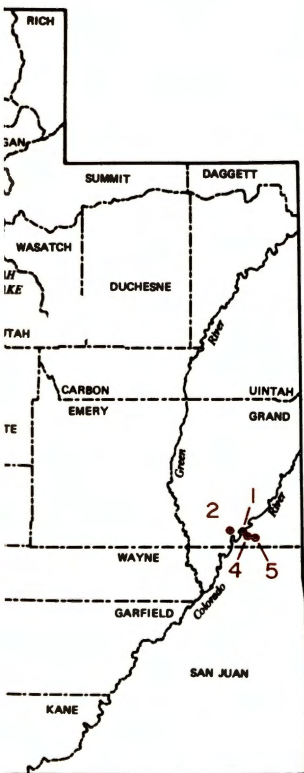
(2) *Texas Gulf, Inc.*'s modern office and plant facility at Cane Creek, west of Moab. Recently Texas Gulf, Inc., flooded its potash mine with water and began pumping saturated solution to surface solar evaporation ponds to harvest potash salts. R. L. Curfman, general superintendent, says evaporation rates at the facility are running close to expectations. Some 100 employees are engaged in solution mining which will produce 300,000 tons of potash compared to 429 workers' 450,000 tons under conventional mining.



(3) *Essex International, Inc.*'s Bwana pit, where extensive drilling at the top of the ridge is being done to determine the extent of the ore body. Oxidized copper ores from skarn and porphyry-type deposits near Milford are mined (see adjacent photo).



Essex International, Inc.'s OK pit. Ore is trucked to the plant site. Essex International, Inc., Beaver County's largest industry, employs an average of 60 people. Production comes from the OK and Maria pits. Exploratory work is being conducted to determine the length of the ore body at the Bwana pit.

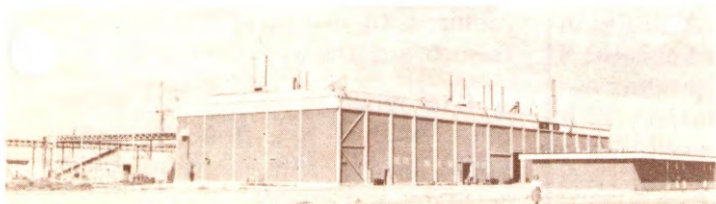


(5) *Keystone Wallace Resources'* soluble copper mill in the worked-out Big Indian sandstone copper open-pit area. The plant, to the south of the Rio Algom Corp. uranium mill, produces cement copper from oxidized copper ores in sandstone deposits (see adjacent photo).



Stockpile in vicinity consists of crushed sulphide ore ready for breaking. Precipitates from the Keystone Wallace pits—"Blue Jay," north of the plant site and "Micro" and the T.G.O. pit, immediately to the south—are trucked to Kennecott Copper Corp.'s smelter at Ely, Nevada.

Brush Wellman, Inc.'s new pit is expected to yield ore for the mill by early 1973. The ore is a fine-grained bertrandite, in contrast to beryl ores which have been the standard raw material source for beryllium metal.



(8) *United States Gypsum Co.*'s operating facilities at Sigurd; reserves of high-quality gypsum rock are estimated at more than 12 million tons. The plant primarily produces construction products; more than 11 miles of wallboard are produced daily. In addition, several kinds of plaster and raw gypsum are marketed.







## "INSECT POWER"

Aside from being nuisances, most insects go unnoticed. But Bruce N. Kaliser, UGMS engineering geologist, has observed "insect



*Left: cut on east bench, north of Uintah, Weber County; clayey silt infested with colony of bees. Above: cut on east bench, south and east of Bountiful, Davis County; box elder bugs hibernating in medium to coarse sand bed.*

power" along the Wasatch front exerting a considerable eroding influence.

Vertical banks in Pleistocene materials are most susceptible, he reports.

## Heber Area Shaken — Data Accumulated

An earthquake October 1 broke chimneys, cracked walls and rattled dishes in the Heber-Midway area. The 4.1 (Richter magnitude) quake also was felt in Salt Lake City, Bountiful and Provo.

A minute and a half later, a 3.8 shock, a reaction to the first, hit the same area. Aftershocks of 2.0 or less were still being recorded two weeks later.

Because there is no quantitative way to measure the effect of tremors near the most intensely shaken area, qualitative information such as the destruction caused or the perceptibility of the shocks to persons is accumulated to construct isoseismal contours (lines drawn on a map through points of equal intensity).

In a cooperative arrangement between Bruce N. Kaliser, engineering geologist, Utah Survey, and K. L. Cook, director, University of Utah seismograph stations, questionnaires containing lists of characteristic earthquake effects were sent to postmasters in the

surrounding area and one was published in a regional newspaper; persons were asked to check items according to their experience of the shock(s) and return them by mail or deposit them in specially marked boxes placed in fire stations and sheriffs' offices throughout the affected area.

The data can be used to determine ground responses in localized areas to earth tremors and what areas are more sensitive to earthquakes. Documentation of this type should guide siting and design of structures to accommodate earthquake hazards.

According to the *Wall Street Journal*, the Federal Reserve Bank District in Dallas, Texas, is running old paper money through a "destructor" and producing a material resembling old cotton. A dealer in oil-well drilling mud and chemicals is accumulating the product in warehouses; he plans to recycle it as an ingredient of oil-well drilling mud.

*(continued from page 3)*

The publications may be purchased in person or by mail from the Publications Office, 103 Utah Geological Survey Bldg., University of Utah 84112. If ordering by mail add 10 percent for handling and mailing.

## Map Releases

Map I-766A, "Surficial geologic map of the Sugar House quadrangle, Salt Lake County, Utah," Map I-766B, "Map showing relative ages of faults in the Sugar House quadrangle, Salt Lake County, Utah," both by Richard Van Horn (\$.75 each), and Map I-672, "Geologic map of the Yost quadrangle, Box Elder County, Utah, and Cassia County, Idaho," by R. B. Compton (\$1.25), are available from the U. S. Geological Survey Public Inquiries Office, Federal Building, Salt Lake City, Utah 84111.

## Reorganized Lab Cuts Cost and Time

In November 1970 the Water Resources Division of the U. S. Geological Survey reorganized water-quality laboratory activities in the western United States. Seven laboratories (servicing sixteen western states) were consolidated into a Salt Lake City facility.

A period to test the new systems analysis began on March 1, 1971, and was completed on February 29, 1972.

According to R. L. McAlvoy, chief of Central Laboratory, costs have been cut about one-third, manpower one-half, and time required to complete the analysis from 6 months to 5 days.

The mode of operation also reduces analyst bias from the analytical results and increases their accuracy and precision.



Above: "G. K. Gilbert" before facelift. Right: the craft, slimmed down and revved up, operates more efficiently and conveniently.

## Survey Craft — Powered to Cruise

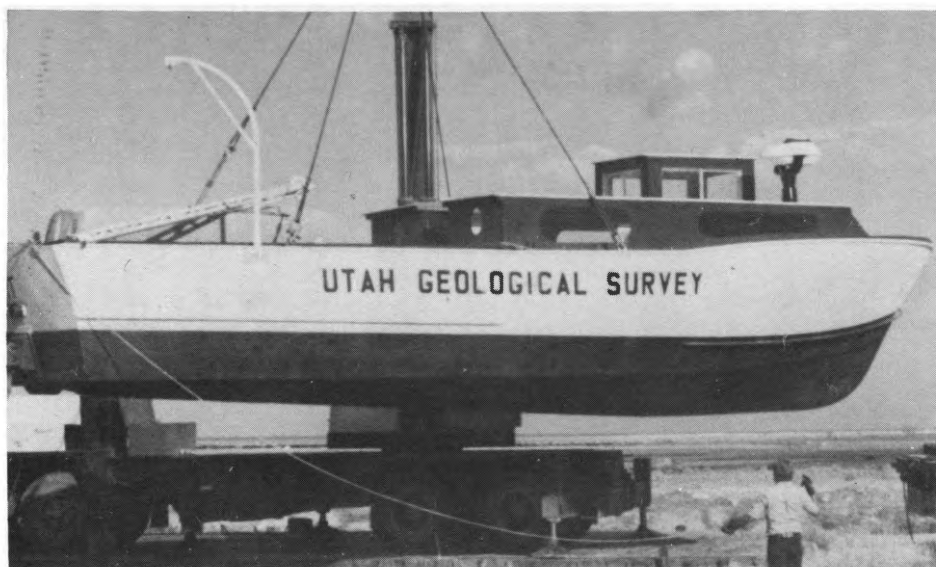
Following reconstruction of the entire deck and cabin area, the G. K. Gilbert, the Survey's 42-foot craft, again was launched in the Great Salt Lake.

The Gilbert, powered by twin 4-53 Detroit Diesels coupled to Twin 14-inch Jacuzzi Jet pumps, was badly underpowered. The U. S. Navy at Mare Island, California, under the command of Captain T. A. Brown, through arrangements made by local civil defense personnel, A. Britton, D. R. Spradling, deputy state director, and John Kinney, regional director, donated larger horsepower engines to UGMS. Transporting the 2/6-71 Detroit Diesel was handled by the Utah National Guard, commanded by General M. L. Watts, who had the engines flown to Salt Lake City.

W. M. Katzenberger, UGMS chief of operations, Great Salt Lake, then installed the engines and redesigned the craft.

The Gilbert has undergone facelifts several times in the past (see *Quarterly Review*, August 1968) but, in the words of UGMS Director W. P. Hewitt, "now it looks like a boat."

Prior to the renovation, Senator Wallace F. Bennett attempted to obtain surplus Patrol Boat River equipment for the Survey; unfortunately such crafts were not available.



Captain F. J. Shaw, recently retired senior U. S. naval officer with the University of Utah's ROTC, and his staff provided names and units to contact for the desired engines.

Katzenberger reports an almost 100 percent increase in operating speed and countless working condition improvements. The new bow-mounted, electric remote-controlled winch adapts to recovering a bow anchor to hoisting over the "A" frame mounted on the stern. The flat roof over the cabin lowered 2 feet doubles working space; the stern deck raised to gunwales height increases head room in the engine compartment and provides easy access to the engine room from the cabin.

The after deck is supported by 2½ x 4-inch box aluminum beams, loosely supported and readily removed for overhead access to the engine for major maintenance or engine removal.

Radar, fathometer and other pilot instruments are conveniently mounted which eliminates the need for a radar operator for night entries into the harbor and for rescue work. Katzenberger has worked closely with State civil defense personnel in life-saving rescue missions on the lake.

The Gilbert is the only State-owned craft that can withstand Great Salt Lake's rough waters.

Sylvia Goeltz, UGMS geologist, is newly elected secretary of the Utah Geological Association—the first woman to hold an office in that organization. L. J. Davis, Brush Wellman, Inc., is president, J. A. Colburn, Mountain Fuel Supply Co., is vice president, and M. P. Barnes, Asarco, is program chairman.

## Earthquake Epicenters

General earthquake epicenters in or near Utah for February, March, April and May 1972, with dates of occurrence and approximate magnitudes, are listed below. Unless otherwise indicated, localities are in Utah.

February	Magnitude
4 North of Salina	2.2
6 Near Emery	2.1
7 Near Kimball Junction	3.1
7 South of Sunnyside	< 2.0
8 Near Green River	< 2.0
11 South of Sunnyside	< 2.0
13 East of Salt Lake City	2.4
15 Five events near Alta	0.5 to 1.0
16 Near Promontory Point	1.9
16 San Rafael Swell	2.6
18 Great Salt Lake near Antelope Island	1.0
19 South of Marysvale	1.6
19 South of Marysvale	1.8
19 South of Marysvale	2.4
21 South of Marysvale	1.8
22 San Rafael Swell	2.6
27 East of Ephraim	1.8
28 Near Scipio	2.2
28 Near Scipio	1.8

(continued on page 8)

(continued from page 7)

## March

2 Promontory Point	1.5
2 North of Green River	2.6
3 Near Richmond	1.9
4 Near Richmond	2.1
5 West of Lehi	2.0
6 Richmond (felt in Richmond and Smithfield, approximate location 41°87'N, 111°61'W)	3.8
7 West of Lehi	2.4
7 West of Lehi	2.3
7 West of Lehi	2.7
7 West of Lehi	2.5
7 West of Lehi	2.0
7 West of Lehi	2.2
7 West of Lehi	2.6
7 West of Lehi	2.0
7 Near Richmond	2.4
8 West of Lehi	2.2
8 Near Payson	1.8
8 West of Lehi	2.0
8 Near Payson	2.0
9 West of Lehi	2.0
10 Near Richmond	2.0
10 West of Lehi	2.4
12 South of Sunnyside	1.4
13 West of Green River	1.5
16 Near Richmond	1.5
16 West of Promontory Point	2.0
16 West shore of Great Salt Lake	1.8
16 West shore of Great Salt Lake	1.7
16 West of Lehi	2.5
17 Near Richmond	1.7
21 East of Montrose, Colorado	3.5
21 South Utah-Nevada border	2.3
22 West of Lehi	2.0
24 West of Lehi	2.2
26 West of Lehi	2.0
30 Northeast of Salt Lake City	2.9
30 Northeast of Salt Lake City	2.0
30 Northeast of Salt Lake City	2.2
30 West of Lehi	2.5
30 West of Lehi	2.6
30 West of Lehi	2.6
30 West of Lehi	2.5
31 East central Nevada	2.5

31 West of Promontory Point	1.7
31 South of Sunnyside	1.4

## April

1 West of Lehi	1.7
1 West of Lehi	1.7
1 West of Lehi	2.1
5 West of Salt Lake City	2.0
5 West of Lehi	1.8
6 West of Great Salt Lake	1.7
7 San Rafael Swell	< 2.0
10 South of Sunnyside	< 2.0
11 East of Salt Lake City	2.3
12 Near Hite	2.4
14 South of Sunnyside	3.6
15 South of Sunnyside	< 2.0
16 Near Coalville	2.6
16 Near Devils Slide	3.5
16 Near Woodruff	1.4
17 San Rafael Swell	3.1
19 Southeast Nevada 35 miles west of Palute, Utah	3.1
20 East of Salt Lake City	1.9
20 Near Ephraim	1.9
20 Near Richfield	< 2.0
21 South of Sunnyside	< 2.0
21 Near Green River	2.5
24 Near Cedar City	< 2.0
25 Near Levan	1.9
25 Near Price	< 2.0
27 Cedar City	3.3
27 Near Emery	2.5
27 Near Cedar City	3.4
28 Near Cedar City	< 2.0
30 South of Sunnyside	< 2.0

## May

1 West of Ephraim	3.0
2 Green River Desert	3.2
2 West of Promontory Point	1.7
5 East of Willard	1.9
7 Near Price	< 2.0
10 South of Sunnyside	< 2.0
11 South of Sunnyside	< 2.0
11 South of Sunnyside	< 2.0
11 South of Sunnyside	< 2.0
11 West of Levan	1.9
13 Near Cedar City	2.5
14 South of Escalante	2.7

14 South Utah-Nevada border	2.7
14 Near Richmond	1.7
15 Near Richmond	2.1
15 Near Richmond	1.9
17 Near Richmond	2.0
19 Near Park City	2.0
19 Near Ephraim	1.7
19 South of Sunnyside	< 2.0
20 South of Sunnyside	< 2.0
23 Southwest of Bountiful	1.9
24 Near Mona	1.9
24 Near Richmond	1.7
24 South of Santaquin	2.7
26 South of Spring City	1.9
27 Southeast of Promontory Point	2.8
28 Near Centerfield	1.9

These earthquakes were recorded by the University of Utah seismograph stations under the direction of Kenneth L. Cook. All locations and magnitudes are preliminary determinations; the final determinations will be printed in the University of Utah Seismological Bulletin, issued quarterly.

## QUARTERLY REVIEW

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