UTAH GEOLOGICAL AND MINERALOGICAL SURVEY

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Too Much Mud At Bridger Bay?

by Harry S. Suekawa*

Last March 11, the Utah Survey's lake crew inspected the Bridger Bay area of Antelope Island to determine the depth of water and the nature of bottom sediments in the bay and at points up to 4½ miles from shore.

Practically the whole offshore area is underlain by algal reef deposits growing on the lake bottom, and during low-water stages, these reefs *could* and *do* pose a navigational hazard to power boats. The reef is widespread and occurs sporadically 2,000 feet from the mouth of the bay and extends away from shoreline in all directions. The water over the reefs is approximately 8 feet, dropping to 6½ feet closer to shore.

The bay itself is a maximum of 8 feet deep. About 50 feet from shore, a shelf parallels the shoreline the length of the bay and drops off suddenly — from 3 to 7 feet in most places.

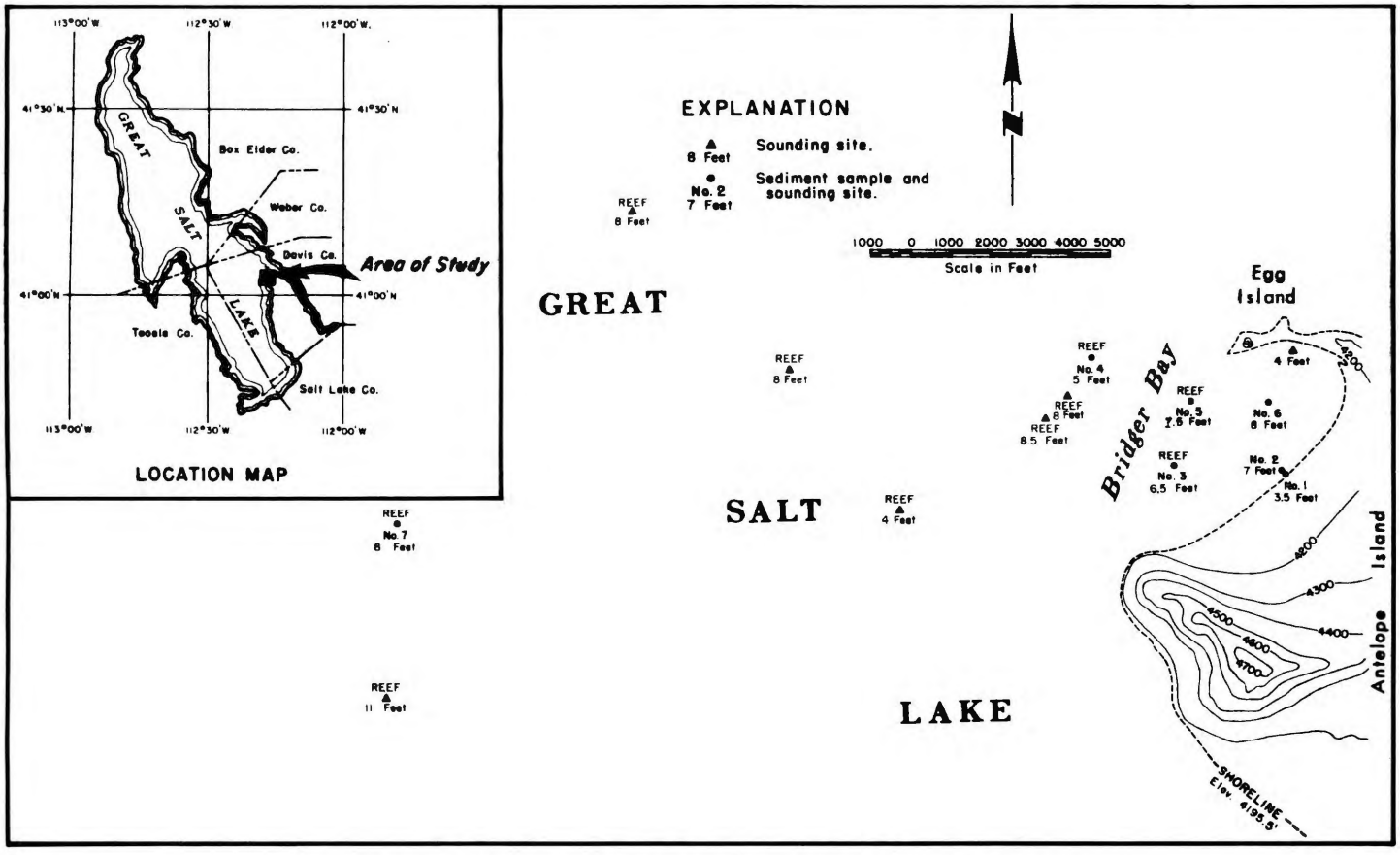
Bottom sediment samples collected in the bay area have been analyzed microscopically to determine the nature of the beach. Samples taken from close to shore consist of the cleanly washed oolitic sand typical of most of the shoreline sands surrounding Antelope. The oolitic sand is well-sorted and makes a good beach cover for recreational purposes.

However, this type of sand disappears as the shelf area is approached. About 50 feet beyond the shoreline, the bottom is a brown, slimy mud. This mud, which is almost entirely made up of brine shrimp fecal pellets, covers the bottom of the entire Bridger Bay area between the shoreline and the reef.

The possibility of Bridger Bay being isolated from the main lake body by a lower water level is remote, because surrounding algal reef heads vary in size and height.

In any event, nearshore mud and the absence of a clean, wide-spread oolitic sand beach could make this area undesirable as a recreational site.

*Consulting geologist, Salt Lake City, Utah; formerly research geologist, UGMS.



Depth and Bottom Sediment Sampling Sites, Bridger Bay Area, Antelope Island, Great Salt Lake, May 25, 1968

COPPER STRIKE REALLY HURT UTAH IN '67

Annual value of mineral output in Utah dropped precipitately from a revised total of $448,877,000 in 1966 to $354,477,000 in 1967, according to the U.S. Bureau of Mines.

This is the first year since 1963 that the State has shown a decrease.

Comparative values for the several mineral commodities and totals for the four principal groups are shown in the accompanying charts.

The combined loss reached $76.5 million for copper, gold, lead, zinc and silver, but most, if not all of this, could be attributed to the copper strike during the last 5½ months of the year. That strike closed not only the huge open pit mine of Kennecott Copper Corporation, but the Tooele Smelter, which treated lead and zinc concentrations.

Iron ore production showed a sharp $1.6 million decrease, although there was no strike in this segment of the industry.

The Moab uranium mill's initiation of vandium recovery resulted in a 20 percent production hike.

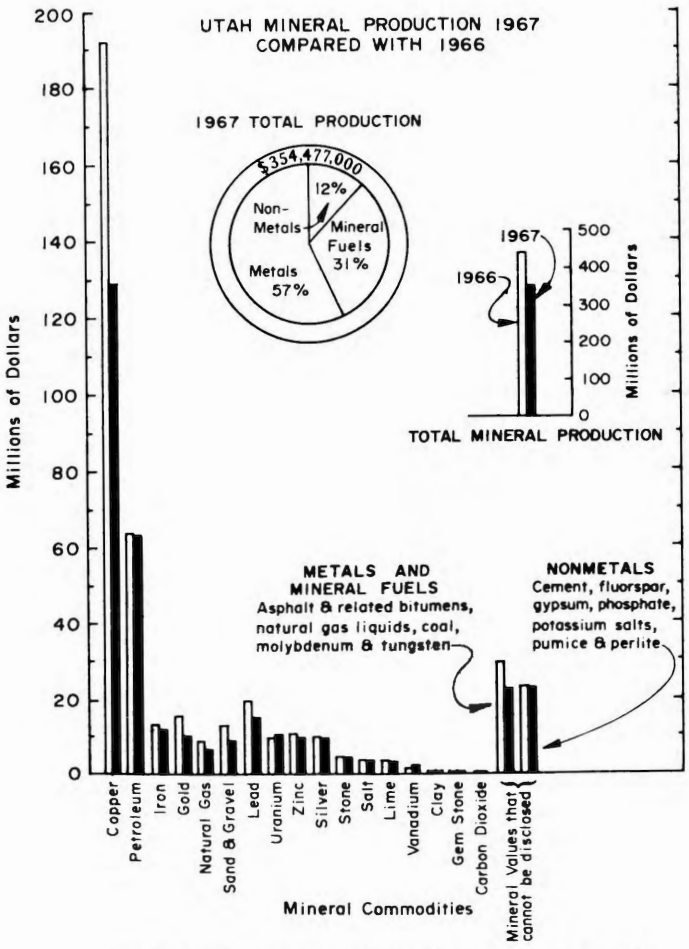
The value for the nonmetals group was off 4 percent, despite a marked gain in production of potassium salts, however, sand and gravel showed a slight gain, but the amount and value of stone dropped. Salt production decreased slightly.

In the area of energy minerals, petroleum production increased a bit . . . both in amount and value over 1966. However, production of natural gas, gilsonite, and carbon dioxide dropped, and the value of coal production was down 9 percent.

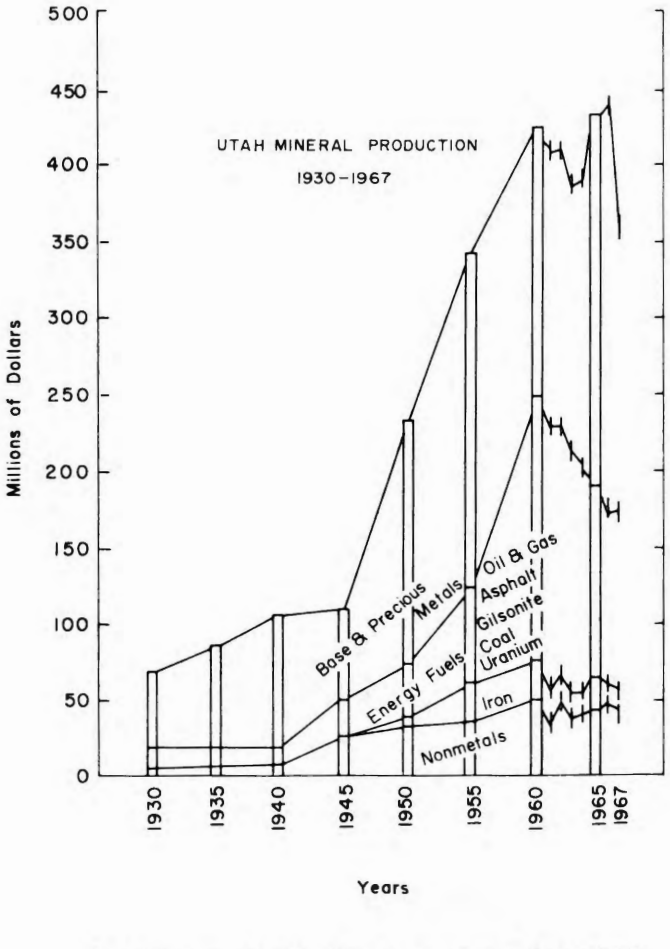
The year saw the closing of U.S. Steel Corporation's Columbia coal mine, but three new mines began producing. Uranium production was off slightly, in spite of greater accelerated exploration activity.

The importance of the mineral industry in the economic pattern of Utah has been demonstrated forcefully by the strike directed against only one company, Kennecott Copper Corp. The *Salt Lake Tribune* noted that by the end of the year, the impact of the strike on Utah's economy could be estimated at $63,410,000.

Many unrelated segments of the mining industry have felt the effect of the copper strike. Production of phosphate rock, for example, had to be curtailed because sulphuric acid, a by-product of the treatment of copper ore and a necessary agent in the production of fertilizer, no longer was available.



Compiled from U.S.B.M. Minerals Yearbooks 1930 - 1966; and Mineral Industry Surveys Area Report for Utah, September 1968.



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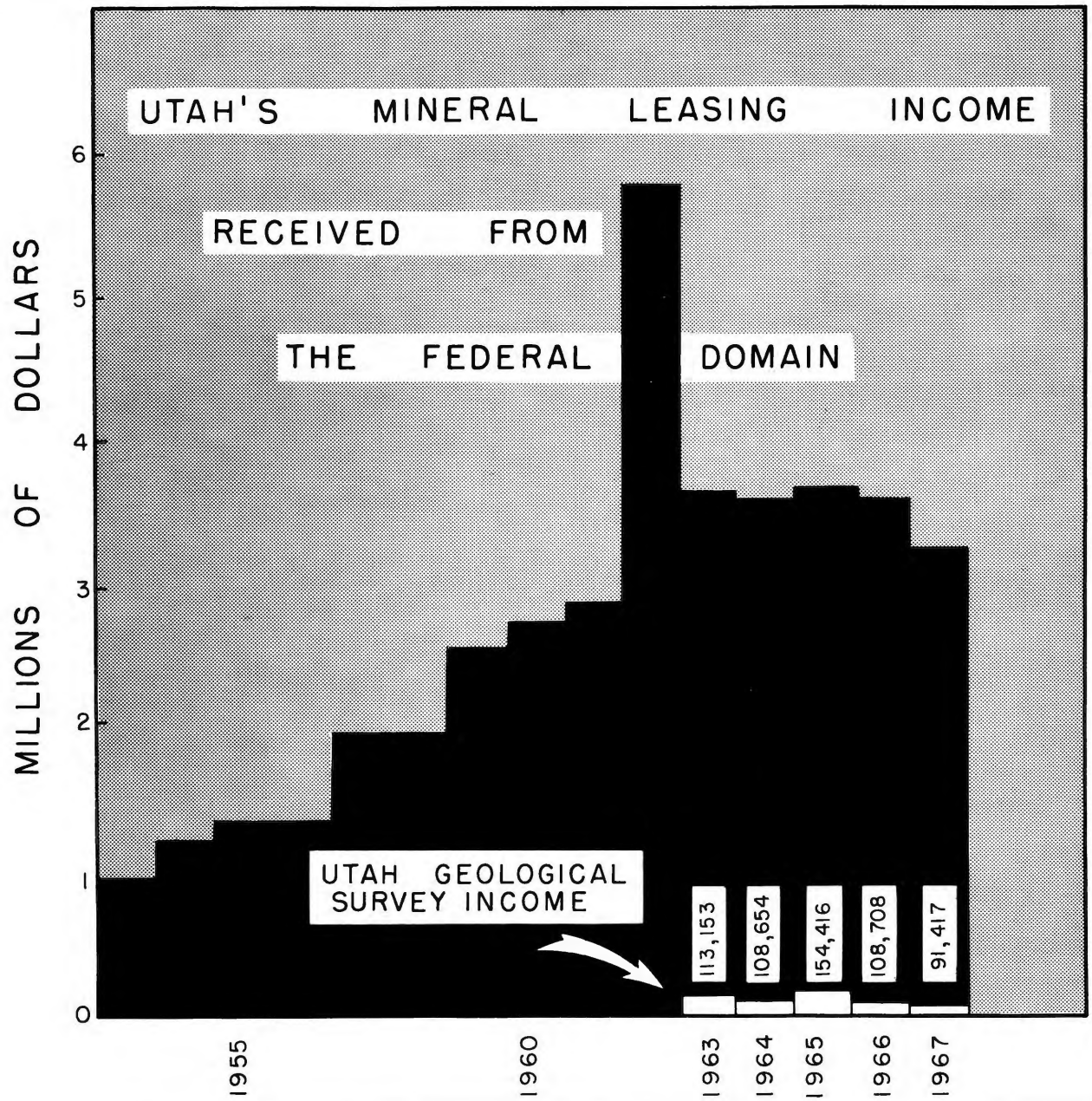


MINERAL LEASING INCOME DIPS AGAIN

Since 1963, the Utah Geological Survey* has received a significant and welcome part of its funds from income derived from mineral leases on Federal lands in Utah. The amount made available has consistently exceeded appropriations from the State general fund. Apportionment for education is as follows:

Universities, colleges, junior colleges 45%

State Uniform School Fund 45%

State Board of Education 3⅓%

USU Water Research Laboratory 3⅓%

Utah Geological Survey 3⅓%

In 1962, mineral leasing income to Utah reached nearly $6 million as the result of flush oil production and brisk oil and gas leasing activity on Federal lands. That year, when an increase was projected, various educational institutions and agencies looked to continuing benefits. The Survey did not share in the 1962 "melon." The following year, mineral leasing income dropped drastically to less than $3.75 million, and since has dropped steadily. The Survey has shared in this declining total from 1963.

In the first half of 1968, the Survey's share came to $49,956 — about $2,000 less than the amount received for the same period in 1967. The second half of 1968 is not expected to reverse the trend.

Oil production in Utah generally has fallen off slowly. Production of natural gas — drastically curtailed by last year's prolonged copper strike — should reach former levels. At the present time, however, gas production also is falling. Other sources of mineral income on Federal lands have a negligible effect on gross monies available.

*The Utah Geological Survey does not directly participate in mineral income derived from State-owned lands.

UGMS FINANCIAL STATEMENT

July 1, 1967 — June 30, 1968

SOURCE OF FUNDS:

Appropriations & Allotments:		
Mineral Leasing Fund: Fiscal Income	$ 91,417.	
Land Grant Maintenance Fund	100,000.	
General Fund	72,000.	
		$ 263,417.
Other:		
Publications Sales (Restricted)	$ 19,913.	
Services Rendered (Restricted)	1,748.	
Cooperative Projects (Restricted)	5,000.	
		$ 26,661.
Carry-Over:		
Operating Funds	$ 31,137.	
Publication Receipts	9,161.	
Services Rendered	567.	
		$ 40,865.
TOTAL FUNDS AVAILABLE	$ 330,943.	$ 330,943.

APPLICATION OR DEPOSITION OF FUNDS:

Employment Costs:		
Staff	$ 86,865.	
Summer Assistance	24,490.	
Time Card Wages	33,628.	
Employee Benefits	10,976.	
		$ 155.959.
Cooperative Costs:		
U.S. Geological Survey	$ 37,500.	
U.S. Bureau of Mines	1,500.	
		$ 39,000.
Contract Service		$ 16,290.
Examination Costs and Travel		18,346.
Equipment, Supplies & Maintenance		27,760.
Printing Costs, Consignment, Taxes, Etc.		16,264.
Remodelling		8,856.
TOTAL FUNDS USED	$ 282,475.	$ 282,475.
BALANCE CARRIED FORWARD	$ 48,468.	$ 48,468.
TOTAL SUMMARY	$ 330,943.	$ 330,943.

EXPENDITURES BY PROGRAM:

Administration	$ 28,131.
Services to Public & State	15,393.
Examinations	
Energy Minerals & Fuels	32,355.
Mineral Deposits & Groundwater	28,325.
Great Salt Lake	45,885.
Engineering Geology	5,288.
Regional Structural and Stratigraphic Studies	20,690.
Cooperative Studies	
U.S. Bureau of Mines	
Oil-field brines	1,500.
Oil-shale investigations	--
U.S. Geological Survey	
Topographic Mapping	20,000.
Water Resources, Ind. Dev. Chem. Hyd. GSL Springs of Utah Causeway Studies GSL	17,500.
Geologic Mapping	--
Urban Mapping	--
Publications - Preparation	43,694.
Oil-Well Sample Library	3,482.
Employee Benefits	10,976.
Equipment	400.
Remodelling	8,856.
TOTAL EXPENDITURES	$ 282,475.

Black Gold In Utah's Circle Cliffs?

by Howard R. Ritzma*

Fieldwork during the summers of 1967 and 1968 has outlined large deposits of oil-impregnated sandstone in the Circle Cliffs area, Garfield County.

Two large deposits were found in the unnamed middle sandstone member of the Moenkopi Formation (Triassic), and two small deposits in sandstones of the Shinarump Member of the Chinle Formation (Triassic).

One Moenkopi deposit extends 10 miles along the crest and east flank of the Circle Cliffs Uplift, from the Studhorse Peaks south beneath Wagon Box Mesa.

*Petroleum geologist, Utah Geological Survey.

The other, located on the southwest flank of the structure, is about 10 miles long and 1 to 2 miles wide.

The two deposits are separated by an area in which remnants of the partly eroded middle Moenkopi indicate the sandstone interval is barren. Both deposits dip beneath the flanks of the huge Circle Cliffs Uplift, and continue for an unknown distance at increasing depth in the subsurface to the east and west.

The eastern deposit appears to be a combined stratigraphic and structural oil accumulation. That on the southwest is almost purely stratigraphic in aspect, with classic cross section exposures of offshore sandbars saturated with heavy oil.

Preliminary analytical work shows that all deposits contain an asphalt base oil of less than 10° gravity (API), and with a 2.5 percent to 3.5 percent sulphur content. Permian Kaibab limestone, which lies below the Moenkopi and Shinarump, may be the common source.

A lack of data makes it impossible to calculate reserves accurately. Nevertheless, together, the two major deposits easily contain 500 million to 1 billion barrels of oil in place — substantially more than the cumulative production

(Continued on next page)

Hazards Group Elects Officers

The Utah Geologic Hazards Committee in a mid-October meeting elected as its new chairman Clifford G. Bryner, associate professor of civil engineering at the University of Utah.

Mr. Bryner succeeds Dr. John Osmond, consulting geologist, who resigned.

Bruce N. Kaliser, UGMS engineering geologist, was re-elected secretary; and George Toland, civil engineer and soils consultant, was appointed by the Consulting Engineers' Council of Utah to serve on the Hazards Committee.

Chairmen named to head subcommittees were: Mr. Bryner; Mr. Toland; Dr. Kenneth L. Cook, professor of geophysics; Dr. Robert B. Smith, assistant professor of geophysics; Dr. Osmond.

SWEETWATER RIM MYSTERY

Two UGMS geologists, working along the Sweetwater Rim last summer, paused to note an old trail bladed by a seismic crew.

The trail led to the edge of the rim, then angled down a narrow spur that projected northward into the San Rafael Desert country below.

Hoping the trail might provide access to outcrops below the rim, the geologists followed it down to where the fast-narrowing ridge and the trail ended abruptly at a knife-edged overlook.

Here the ground fell away precipitously on three sides into deep canyons cut in soft, red Entrada Sandstone.

One man cautiously stepped backward from the precipice. As he did so, a solid-looking slab of sandstone underfoot wobbled precariously and emitted an ominously hollow sound.

Gingerly, the two lifted the slab, uncovering an unfilled seismic shot hole. More surprising was the sound of splashing water as rock fragments skittered down the 3-inch bore.

By timing the interval from surface to splash, water could be estimated at 70 feet below the surface of the ground.

Astonishingly, the 5-foot wide spur on which the shot hole had been drilled dropped off at 45° angles 275 to 400 feet on either side and even more steeply off the point of the ridge.

Nowhere was any evidence of moisture visible. Even the hardiest desert vegetation found difficulty in clinging to the steep, rocky slopes. The narrow canyons on either side were devoid of even a spot of dampness.

Obviously this strange situation can be explained as a perched water table —and probably the most precariously perched one in Utah. — HRR

(Continued from Page 4)

(335,000,000 barrels) of all of Utah's oil fields to date.

Circle Cliffs Anticline, a broad regional uplift more than 60 miles long and from 12 to 20 miles wide, has been explored for oil by only two wells. Both wells are on the structural apex of the fold in the Wagon Box Mesa area.

The northwest plunge of the structure is broken by at least one area of independent structural closure and several structural terraces. The long, gentle south plunge averages less than a 2° dip for over 30 miles. The west flank, which averages a 5° dip for 10 to 15 miles, is interrupted by several gentle terraces and zones of faulting.

Closure of Circle Cliffs Anticline is about 1,200 feet, and embraces an area of 185 to 200 square miles. All this and only two wells.

Erosion has breached the structure to the Kaibab Limestone and White Rim Sandstone Member of the Cutler Formation (Permian) on the crest. About 6,000 feet of Permian, Pennsylvanian, Mississippian, Devonian and Cambrian sediments lie beneath the Kaibab.

With only a wide scattering of wells in the entire region, the stratigraphy of these units and significant factors leading to possible entrapment of oil and gas are conjectures.

Quarterly staff: Gladys V. Isakson, editor; Paula Young, assistant; Ann Allen, Terry Talcott and Sharon Monson; Connie Evans, artist.

The flanks of Circle Cliffs Uplift and the long gentle plunges to the north and south are considered prime areas for stratigraphic oil entrapment to occur. The sharply flexed east flank (well-known as the Waterpocket Fold) may conceal overthrust faulting that could trap large quantities of oil.

The Muley Twist oil-impregnated sandstone deposit, trapped in an up-dip pinchout of Shinarump sandstone, lies in the heart of the Waterpocket Fold. Its occurrence suggests the Shinarump may harbor other stratigraphic oil accumulations elsewhere in the area and hints at possible "leakage" upward from deeper fault or stratigraphic traps.

On the west flank, one fault system cutting the post-Moenkopi rocks contains tar that oozes along fracture planes.

This occurrence makes it possible to project oil-impregnated sandstone with certainty into the subsurface westward from the outcrop where it was last seen dipping beneath cover.

The giant Circle Cliffs Uplift attracted oil drillers in 1922, and again in 1953 and 1954. Although the two wells drilled have been unsuccessful, it would seem they have barely "scratched the surface."

The Circle Cliffs and the broad region around it have exciting petroleum potential. Both conventional oil occurrences and surface deposits of oil-impregnated sandstone are indicated. It is an area close to home that Utahns will watch with interest.

U. Professors Garner Honors

Two University of Utah faculty members were mentioned in the November issue of *Geotimes*.

The magazine notes that Dr. George R. Hill, Dean of the College of Mines and Mineral Industries, has been honored for distinguished service by the Utah Petroleum Council.

The name of Dr. Harry D. Goode, professor of geology, who received honorable mention in the American Geological Institute's geological photo contest, appears also.

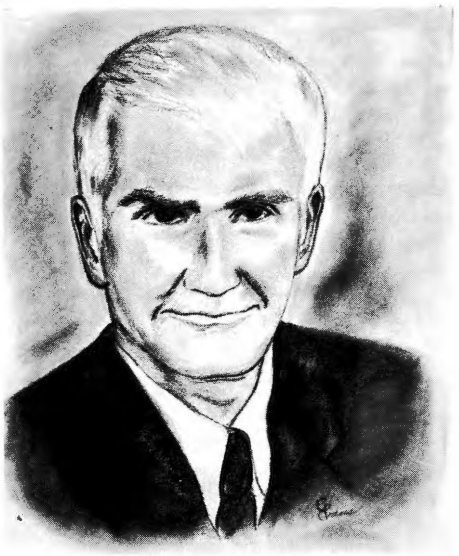
Dr. Hill's "interest in the development of petroleum and its products" was the basis of the award.

The presentation was made at a luncheon held during the Council's annual meeting in Salt Lake City. Approximately 400 Utah oil industry employees attended.

In making the presentation, Council vice-chairman Rod A. Sovereign cited Dr. Hill for his outstanding studies and works on oil, coal, shale, and other mineral deposits.

PETROLEUM'S FUTURE

'We're In The Energy Business'



George H. Galloway

"I think the crude oil is there to find and produce, but it's going to take some remarkable people to find and produce it."

Such is the optimistic opinion of George H. Galloway, executive vice president, Pan American Petroleum Corporation.

In a recent interview for *Horizons,* his company's magazine, Mr. Galloway expanded statements he made in "Outlook for Petroleum in the United States," a paper he presented at the 1968 annual meeting of the American Association of Petroleum Geologists at Oklahoma City.

Asked for his best estimate of how much petroleum will be needed by the United States in the next 30 years, the petroleum executive replied:

"Strictly in terms of numbers, the United States currently consumes about 12 million barrels of petroleum products each day — about 4.4 billion barrels a year. We can expect the demand for petroleum to increase about 3 percent each year. This means that in the next 10 years this nation will need 52 billion barrels of oil. Over the next 20 years, we will need 119 billion barrels; and in the next 30 years, we will need 200 billion barrels of oil.

"To put these figures into perspective, the United States now has total proved reserves of 38 billion barrels of crude and natural gas liquids. This is about an eight-year supply of petroleum at predicted demand rates . . ."

At one point, he noted that "many industry observers view these figures as indicators of the industry's inability to provide for the country's future needs. I look at them very differently, and I think these results were just what we should have expected in view of overall industry conditions in the last 10 to 12 years . . . ," he said.

Citing the tremendous increase in demand projected for the United States, Mr. Galloway pointed out that no one knows whether or not Pan American and other oil companies will be able to supply it.

"Let me say that I think the oil is there. The real question is 'can we find it at a profit?' I think we can if we are given the proper incentives."

Questioned as to the type of incentives needed to stimulate petroleum production, he said:

"I'll give you an historical illustration. Throughout most of the 1930's the oil industry was faced with burdensome surplus capacity and inventories, and low prices. This killed the incentive for making new investments to find and develop new reserves.

"In contrast, the period after World War II was one of strong prices, high demand and low surplus capacity, all of which offered strong incentives for the industry to find and develop new reserves . . ."

To Mr. Galloway, opportunities are not limited just to the geographic frontiers.

"Even in the most heavily prospected parts of North America, there are many wildcatting opportunities . . . So, as I see it, the challenge confronting the industry is not finding substantial volumes of reserves, but finding them at a reasonable cost."

At this point, he switched to substitute fuels.

"We are looking for . . . a cheaper source of crude oil," he said. "Conventional crude is caught between high costs of exploration and production on one side and the low price of the produced crude on the other.

"To the extent that these energy sources — shale oil, tar sands, etc. — can offer cheap alternatives, these sources should provide an increasing amount of the supply in the future.

"So, I think that's the answer. Substitute fuels may some day be attractive because it may work out that they can be produced cheaper than conventional crude . . . not because the nation is running out of conventional crude.

"The problem with substitute fuels," he went on, "appears to be the high cost of extracting or manufacturing them . . . and this is no small problem . . .

"I have complete faith in my belief that this industry can either find the quantities of oil we will need or, failing that to any degree, will develop the necessary substitutes.

"I find it reassuring that oil companies are leading the research work on developing substitute fuels. It shows we are taking the broad view . . . that we are in the energy business rather than just the conventional crude oil and gas business.

"I think, too, that the transition from a dependency on crude to a dependency on its substitutes will be a relatively painless experience, if and when it happens."

Mr. Galloway does not subscribe to the feeling that the exciting, challenging era of the oil business lies somewhere in the past.

"I think we in the business can expect both Federal and state governments to understand our problems and to help us meet this challenge of tremendously increasing demand. A healthy domestic petroleum industry is vital to our nation's progress and security. We learned again last summer, during the Middle East flareup, that we cannot depend on foreign sources for our supply of petroleum . . ."

Although convinced the industry can handle the responsibility, he pointed out that "there is another part of the total picture that I haven't touched on . . . and it's one of the most necessary and vital factors: People.

"Our challenges in the next 32 years are fantastic, and we are going to need the people to match them.

"I said that I think the crude oil is there to find and produce, but it's going to take some remarkable people to find and produce it. It's going to take people with imagination . . . people with good technical backgrounds . . . people who can think of new and better ways of doing things . . . people who aren't afraid to try new things," he stressed.

"For those people, the future will be exciting and rewarding. Many of them are in our company now. . . many will be hired in coming years. I think that the search to find and develop these people will be just as profitable as finding and developing a new oil or gas field."

This unusual pair of photos shows Echo Canyon before and after the slide of May 12 (see arrow). In the top picture, taken while I-80 was under construction, note the northeast dip of beds (to the right) into the newly created cut. The bottom picture is a view of the slide taken from across the canyon. (Photos by John Hopkins, geologist, Utah State Highway Department.)

Spring Slides Ravage Echo Canyon

Geologically speaking, spring is the time of year when rock and soil failures can be expected.

This year proved to be no exception in Echo Canyon, Utah.

May 12, more than 400,000 cubic yards of rock and debris poured across two lanes of Interstate 80 in Summit County,* snapping 16 transcontinental telephone lines in the path of the moving earth.

Because of the slide's extent and because the toe is retaining the bulk of the material, the Utah State Highway Department's Geology Division recommended skirting the toe rather than attempting to remove it.

On July 10, a cloudburst's deluge triggered a mudslide less than a mile away from the first slide. On that occasion, flooding at Pole Canyon, which is tributary to Echo Canyon, deepened its channel significantly and reworked the deposits of older flows.

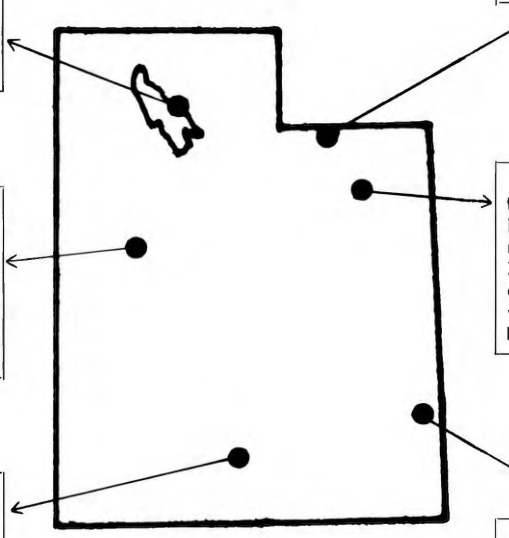
The heavy sediment (mostly gravel), up to 6 feet thick, blanketed about 1,000 feet of road, effectively plugged the interstate highway and Echo Creek and ripped out about 400 feet of guardrail.—BNK

*SE corner, Henefer, Utah, 7½ min. quad.

INDUSTRIAL HIGHLIGHTS – MINING AND PETROLEUM

The Great Salt Lake Minerals and Chemical Corporation has been precipitating salts (Mg, K, Na, Br, Li) from the Lake's brines since April 30, 1968. Some 12,000 acres of solar evaporation ponds currently are involved in the crystallization processes. The company contemplates spending $10,000,000 on new extraction facilities, and the Utah Power and Light Company, $2,500,000 for a power plant. It is expected that salts for plant feed will be harvested by the spring of 1970. About $10,000,000 were spent to install the evaporation ponds and another $2,500,000 on research and other developments.

Phillips Petroleum's seventh flowing well is producing 866 barrels per day from Cretaceous Dakota sands below 15,000 feet. Locations have been staked for two more Dakota wells. Phillips currently is drilling a Jurassic Nugget Sandstone test proposed to 18,000 feet. That test is underway at No. 10 Unit on the northeast side of the field. By the end of August, Bridger Lake had produced nearly 1,975,000 barrels of oil and was averaging 395 barrels per day per well.



Brush Beryllium Company began strip-mining its properties in Juab County May 30, 1968. Late this year or early next, ore will be shipped to the company's processing plant in Lyndyll, Utah. The plant boasts an $8-$10 million mining and milling complex. Because of this plant, Utah will become the largest producer of beryllium in the United States and possibly the world.

Completion of seven deep wells from Tertiary Green River sands has stimulated interest in the Bluebell Field. Chevron Oil's first test netted 1,080 barrels a day; its second, about 700 barrels a day. Two new locations have been announced and drilling on two wells is underway. Production is from 10,600 to 10,800 feet. Four wells are pumping. Three are flowing.

Tenneco Oil's No. 14 Unit, the tenth producing well in the Upper Valley Field, is pumping 544 barrels per day from Permian Kaibab limestone. The company's No. 15 Unit is testing, and production of 980 barrels per day is projected. The field passed the million barrel mark in cumulative production in mid-April, and was averaging 295 barrels per day per well in August 1968.

The Rio Tinto Mining Corporation recently completed a deep-drilling program to intersect new ore in the Chinle Formation of the Big Indian-Lisbon mining district. Rio Tinto currently is preparing to sink two shafts (15 and 18 feet in diameter, respectively) to the 2,600- to 2,750-foot-deep Chinle.

Utah Survey Lists New Publications – In Stock And In Press

NEW PUBLICATIONS:

Special Studies 23, Pyrophyllite-Bearing Clay in Clinton Deposit, Utah County, Utah, by G. V. Henderson; $2.00

Special Studies 25, Carcass Canyon Coal Area of Kaiparowits Plateau, Garfield and Kane Counties, Utah, by Hellmut H. Doelling; $2.00

Map 25, Preliminary Location Map, Oil-Impregnated Rock Deposits of Utah, compiled by Howard R. Ritzma; $1.50

Map 26, Volcanic Stratigraphy, Magnetic Data and Alteration Geologic Map and Sections of the Jarloose Mining District Southeast of Minersville, Beaver County, Utah, by Max P. Erickson, assisted by Julius Dasch; $1.00

Water-Resources Bulletin 10, Dissolved-Mineral Inflow to Great Salt Lake and Chemical Characteristics of the Salt Brine: Summary for Water Years 1960, 1961, and 1964, by D. C. Hahl; $2.00

IN PRESS:

Special Studies 24, Mineral Resources, San Juan County, Utah, and Adjacent Areas, Part I: Petroleum, Potash, Groundwater, and Miscellaneous Minerals, by Howard R. Ritzma and Hellmut H. Doelling.

Special Studies 24, Mineral Resources, San Juan County, Utah, and Adjacent Areas, Part II: Uranium, by Hellmut H. Doelling.

Special Studies 26, Determination of Oil Shale Potential in the Green River Formation, Uinta Basin, Northeast Utah, by Howard R. Ritzma and deBenneville K. Seeley.

Special Studies 27, Stratigraphy and Economic Significance, Currant Creek Formation, Northwest Uinta Basin, by Robert F. Garvin.

Water-Resources Bulletin 11, Reconnaissance Appraisal of the Water Resources near Escalante, Garfield County, Utah, by Harry D. Goode.

Circular 53, Bibliography of Great Salt Lake, by Harry S. Suekawa.

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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