

OIL-IMPREGNATED ROCK DEPOSITS OF UTAH

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GEOGRAPHIC DISTRIBUTION

Utah's 53 deposits of oil-impregnated rock are mainly grouped within and around the Uinta Basin of northeast Utah and in the central southeast part of the State; twenty-five deposits are in the Uinta Basin and 22 in the central southeast. Six minor or small deposits occur in the northwest, southwest and far southeast parts of the State.

GEOLOGIC DISTRIBUTION

Twenty-three of 25 deposits in the Uinta Basin contain oils which almost certainly originated in source beds of Tertiary age, most probably the lacustrine Green River Formation. In about 13 of the 23 deposits, the oil has remained in the Green River Formation or in the Wasatch immediately beneath. These *in situ* deposits are mostly on the gentle south flank of the basin. On the strongly folded and faulted north flank of the basin, oil traps apparently were ruptured causing oil to migrate into younger or older formations depending on the structural situation (migrated deposits). The Whitecliffs deposit contains Tertiary oil in the Jurassic Navajo Sandstone. In six deposits, oil has moved upward into porous sands in the Duchesne River Formation. At Asphalt Ridge, oil occurs in sandstones above and below the unconformable contact of the Duchesne River Formation with the underlying Mesaverde Formation (Upper Cretaceous). At Asphalt Ridge Northwest, Tertiary oil occurs in a lower Mesaverde sandstone. In the central part of the basin, oil apparently moved upward along faults and fractures and lodged in the Uinta Formation (Pariette and Chapita Wells deposits).

Only one Uinta Basin deposit, Split Mountain, contains certain Paleozoic oil in Permian rocks. The Daniels Canyon deposit in Permian-Pennsylvanian rocks probably contains oil which migrated upward along fractures through an extensive overthrust sheet from Tertiary rocks beneath the thrust.

Central Southeast

Most of the oil in deposits in central southeast Utah is contained in rocks of Permian and Triassic age, most of it in the Permian White River Sandstone in the Tar Sand Triangle. The amount of oil found in Triassic formations in the San Rafael Swell and the Circle Cliffs is remarkable considering the sparse productive record of Triassic formations in Utah's oil fields.

Scattered occurrences of oil in Cretaceous and Jurassic formations in the area are of scientific interest, but of little commercial value.

The deposits of the Tar Sand Triangle, Circle Cliffs and San Rafael Swell are considered primarily *in situ* deposits. In the Tar Sand Triangle considerable downward gravity migration has occurred after the original trap was breached by erosion and the water drive dispersed.

The Salt Wash, Sweetwater Dome, Ten Mile Wash and Thousand Lake Mountain deposits appear to be the only migrated deposits in the central southeast region.

Other Areas

Six more deposits are scattered in other areas of Utah. Four deposits, occur in the Moenkopi Formation (Triassic) in Washington County, southwestern Utah. The Rozel deposit occurs along the shore of the north arm of Great Salt Lake. Here small quantities of an unusual oil rise along a fault and saturate Recent muds and salt on the lake shore. The deposit is submerged during high water.

Oil-impregnated limestone reefs in the Hermosa Formation (Pennsylvanian) along the Canyons of the San Juan River in southeast Utah comprise the oldest deposit in Utah.

LITHOLOGY OF DEPOSITS

Most deposits, particularly those of major size, occur in sandstones which, with finer grain size, grades into siltstone and, with coarser grain size, grades into grit and conglomerate. More than 90 percent of the estimated oil in place in Utah's deposits is contained in sandstone and siltstone.

Along the south flank of the Uinta Basin, the Argyle Canyon, Minnie Maud Creek and Willow Creek deposits contain notable amounts of oil-impregnated limestone in the Green River Formation. The Thistle deposit, also in the Green River, contains considerable heavily impregnated oolitic limestone and coquina. The Split Mountain deposit occurs in coarse crystalline and vuggy Park City Formation limestones. The Daniels Canyon deposit occurs in highly fractured quartzite and siliceous limestone.

In central southeast Utah all deposits are contained in sandstone, siltstone and some conglomerate, except for small amounts of oil-impregnated limestone found in San Rafael Swell and Teasdale deposits and localities.

In southwest Utah, three deposits are in limestone or sandy limestone. The North Creek deposit occurs in sandy shale and shale.

The Mexican Hat deposit (San Juan County) occurs in Pennsylvanian carbonates and the Rozel deposit (Box Elder County) is found in oolitic mud and salt on the shores of Great Salt Lake.

ORIGIN, MIGRATION AND ENTRAPMENT

Oil contained in these deposits originated in the same way as oil found in conventional oil fields. The source was organic material contained within rocks laid down in situations in which the organic material was converted to petroleum. The petroleum has been trapped by fortuitous stratigraphic or structural conditions close to its area of origin (*in situ* deposit) or has migrated unknown distances to become trapped at another locality (migrated deposit). Since the oil in oil-impregnated rocks is exposed to the atmosphere, volatile constituents usually found in conventional oil and gas fields at depth have escaped. The oil has also been degraded by bacterial action and altered by contact with oxygen-rich fresh water. The oil in oil-impregnated sandstone deposits is, therefore, "heavy", viscous, and has a low gravity rating. Usually the quality of the oil increases with distance from outcrop exposure and with increasing depth.

Oil migration may have taken place laterally along bedding planes, through permeable sandstone or limestone or along lateral or vertical conduits formed by faults, fractures and joints. Studies of many deposits show that fractures and joints associated with faulting are important migration routes. Faults frequently form barriers to migration and may cause entrapment. However, stratigraphic factors, principally porosity and permeability variation, appear to be much more important than structure.

Deposits along the structurally complex north flank of the Uinta Basin from Daniels Canyon on the west through Rim Rock on the east result from rupture and tilting of deep-seated traps with oil escaping to the outcrop along faults, bedding planes, fractures and joints. All oil appears to have originated in the Green River or Wasatch Formations with migration following various conduits upward and laterally for many miles.

The deposits from Raven Ridge around the east and south flanks of the Uinta Basin are gigantic stratigraphic traps in which oil from the highly petroliferous Green River Formation was trapped in porous sandstones in the Green River and underlying Wasatch Formation close to its area of origin. Deposits such as P. R. Spring and Sunnyside are actually giant oil fields breached by erosion.

Some deposits may become economically profitable to exploit because of the presence of valuable by-products associated with the oil or bitumen. These include uranium, vanadium, selenium and rare earth elements.

The Circle Cliffs deposits are partially within the extended boundaries of Capitol Reef National Park and the remainder of the deposits is within areas proposed for various scenic, recreation and wilderness preserves. Access to the deposits is severely limited.

The Tar Sand Triangle deposits lie mostly within the Glen Canyon National Recreation Area and immediately west of Canyonlands National Park. Access to the area for development purposes is severely restricted.

Other conflicts over land use and environmental considerations are expected to greatly influence development of all of Utah's deposits, particularly those susceptible to open-cut mining methods.

At present, both mining and *in situ* processes are contemplated as methods of development of this resource. From the point of view of conservation, the percent of recovery possible by mining, particularly open-cut methods, is an increasingly important factor to consider. Mining and processing oil-impregnated sandstone may result in more than 90 percent recovery of oil. *In situ* methods may achieve only 10 to 20 percent. The loss of the resource by *in situ* methods may be unacceptable in times of scarcity and great need in future decades.

ANALYSES OF EXTRACTED OIL

Assay and distillation analyses of 53 oils extracted from Utah's oil-impregnated sandstone deposits were tabulated by Wood and Ritzma (1972).

The oils vary widely in composition from deposit to deposit and considerably within some individual deposits. Sulfur content is the most obviously significant variable.

Uinta Basin

Sulfur content of oils originating in Paleocene or Eocene formations range from 0.19 to 0.82 percent in 39 samples from 16 deposits (Wood and Ritzma, 1972). In three instances, Asphalt Ridge, Asphalt Ridge Northwest and Whitecliffs, the oils have migrated into older formations of Cretaceous and Jurassic age. Gwynn (1971, p. 17) reports sulfur contents of 34 samples of oil from the P. R. Spring deposit ranging from 0.22 to 0.42 percent.

Analyses of samples not previously reported from several deposits indicate contents as follows:

Deposit	Percent
Argyle Canyon	0.25, 0.35
Chapita Wells	0.66, 0.87
Daniels Canyon	0.62
Pariette	0.30
Raven Ridge	0.14 to 0.38 (13 samples)
Sunnyside	0.60
Thistle	1.07

Only the Thistle sample appears to deviate to any extent from the usual low sulfur content. The Daniels Canyon oil appears to be Tertiary oil which has migrated into overthrust Pennsylvanian-Permian Quairrh Formation quartzites.

A significant contrast is the Split Mountain deposit found in the Permian Park City Formation. This undoubted Paleozoic oil has a sulfur content of 2.94 percent.

Central Southeast

Sulfur content of oils extracted from central southeast Utah deposits (summarized below) is significantly higher than that from Tertiary deposits in the Uinta Basin.

Deposit	Geologic Age	No. of Samples	Sulfur (percent)
Circle Cliffs ¹	Permian-Triassic	11	3.02-4.36
Circle Cliffs ¹	Triassic	1	2.37
Tar Sand Triangle ¹	Permian	5	3.13-4.25
Tar Sand Triangle ¹	Permian	1	6.27
San Rafael Swell (5 deposits)	Triassic	9	2.57-5.08
Cottonwood Draw	Triassic	1	1.64
Thousand Lake Mountain	Jurassic	1	4.48
White Canyon	Permian	1	2.73

¹Wood and Ritzma, 1972.

The two Jurassic deposits sampled, Ten Mile Wash and Salt Wash, yielded oil with sulfur contents of 4.16 and 2.16 percent, respectively.

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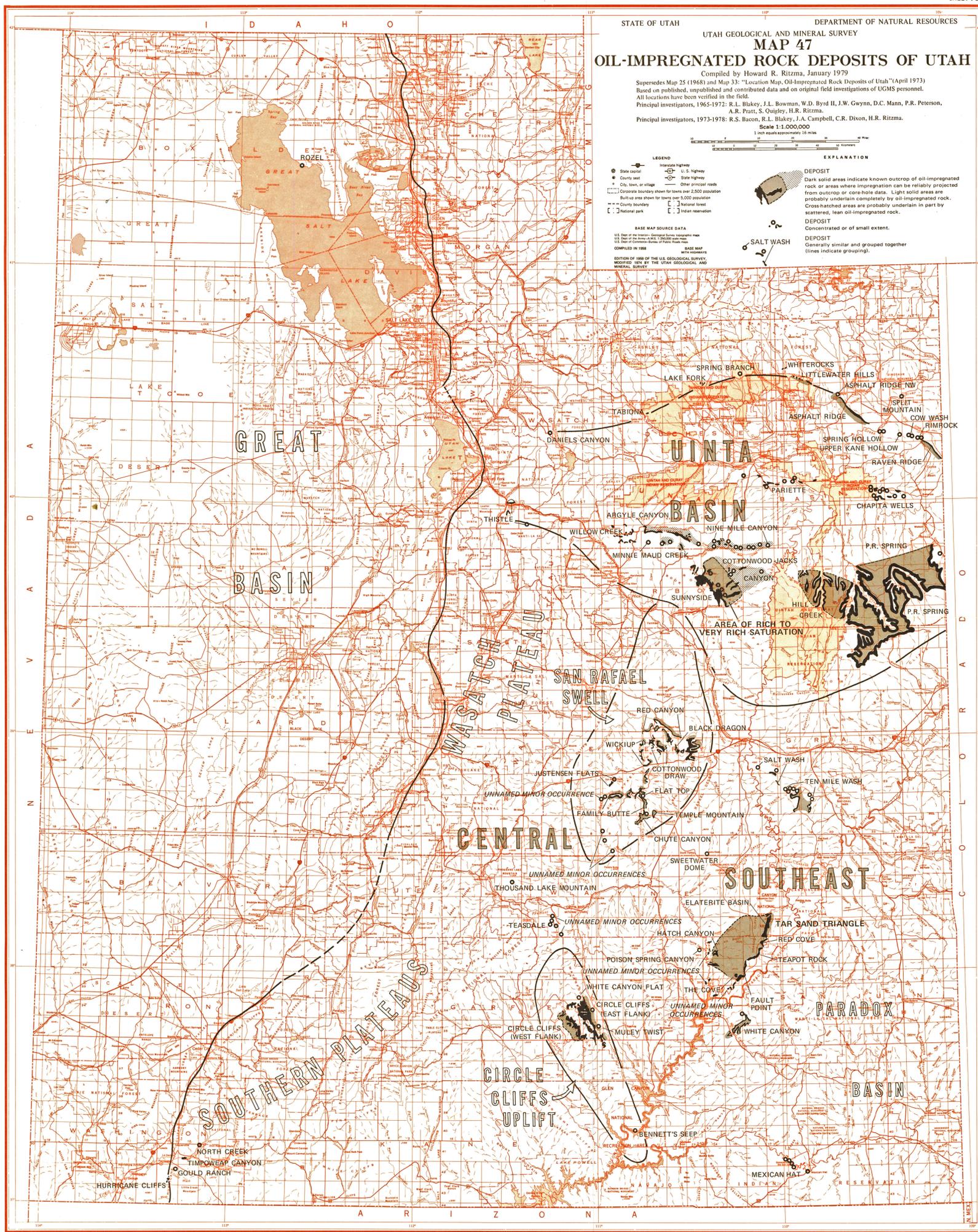
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OIL-IMPREGNATED ROCK DEPOSITS OF UTAH

A	B	C	D	E	F	G	H
DEPOSIT (Name previously used or name of smaller occurrence within deposit-see list at right for comparison with nomenclature used in Map 25, 1968)	LOCATION Township (s) and Range (s); Section (s) if localized UM = Uinta Meridian	COUNTY (S)	FORMATION (S) IN WHICH DEPOSIT OCCURS (Geologic age)	DOMINANT LITHOLOGIES	SIZE OF DEPOSIT	GROSS OIL IN PLACE (million barrels) ¹ m= measured i= indicated i/c= inferred or conjectural	SOURCE OF DATA IN COLUMNS F AND G
UINTA BASIN							
ARGYLE CANYON (Indian Canyon, Lake Canyon)	T. 11 S., Rs. 11, 12 and 13 E.; T. 10 S., R. 11 E.; T. 7 S., R. 7 W. (UM)	Duchesne	Green River Fm. (Eocene), deltaic facies, Parachute Creek Mbr. and Evacuation Creek Mbr. (in ascending order)	Sandstone and siltstone with limestone	Large	50 to 75	Estimate by UGMS, 1978
ASPHALT RIDGE	Ts. 4, 5 and 6 S., Rs. 20, 21 and 22 E.	Uintah	Duchesne River Fm. (Eocene) and Rimrock Ss. Mbr. of Mesaverde Fm. (U. Cret.)	Sandstone and siltstone	Giant	1,048 435 m 438 i 175 i/c	Spieker, 1930, Covington, 1963 1964a and b, 1965; Kayser, 1966; combined with estimates by UGMS, 1972 and contributed data
ASPHALT RIDGE, NORTHWEST	T. 4 S., R. 20 E., Secs. 23 and 24	Uintah	Asphalt Ridge and Rimrock Mbrs. of Mesaverde Fm. (U. Cret.)	Sandstone	Very large (much in subsurface)	100 to 125	Estimate by UGMS, 1978 combined with contributed data
CHAPITA WELLS	T. 9 S., Rs. 21 and 22 E.	Uintah	Uinta Fm. (Eocene)	Sandstone	Medium-small	7.5 to 8	Estimate by UGMS, 1972
COTTONWOOD-JACKS CANYON	Ts. 11, 12 and 13 S., Rs. 14, 15 16, 17 and 18 E.	Carbon and Duchesne	Green River Fm. (Eocene), deltaic facies	Sandstone and siltstone	Large	20 to 25	Estimate by UGMS, 1978
COW WASH	T. 6 S., R. 24 E., Secs. 20 and 21	Uintah	Green River Fm. (Eocene)	Sandstone and conglomerate	Medium-small	1.0 to 1.2	Estimate by UGMS, 1972
DANIELS CANYON	T. 6 S., R. 6 E., SE NW SW Sec. 10	Wasatch	Oquirrh Fm. (Permo- Pennsylvanian)	Limestone and quartzite	Minor	-	Estimate by UGMS, 1972
HILL CREEK	Ts. 13, 14 and 15 S., Rs. 18, 19, 20 and 21 E.	Uintah	Green River Fm. (Eocene), Douglas Creek Mbr.	Sandstone and siltstone	Giant	1,160 350 m 480 i 330 i/c	Estimate by UGMS, 1972
LAKE FORK (Lake Fork-Yellowstone, Yellowstone, Black Diamond)	T. 1 N., R. 4 W., Secs. 5 and 6; T. 1 N., R. 5 W., E½ NE Sec. 1 (UM)	Duchesne	Duchesne River Fm. (Eocene)	Sandstone	Medium-small	6.5 to 10	Estimate by UGMS, 1972 combined with contributed data
LITTLEWATER HILLS (Deep Creek, Deep Creek Nose)	Ts. 1 and 2 N., Rs. 1 and 2 E. (UM); T. 3 S., R. 19 E., Sec. 34	Uintah	Duchesne River Fm. (Eocene)	Sandstone and conglomerate	Large	10 to 12	Estimate by UGMS, 1972
MINNIE MAUD CREEK (Indian Canyon, Lake Canyon)	Ts. 11 and 12 S., Rs. 11, 12 and 13 E.	Duchesne and Carbon	Green River Fm. (Eocene), deltaic facies and Parachute Creek Mbr.	Sandstone and siltstone with limestone	Large	10 to 15	Estimate by UGMS, 1978
NINE MILE CANYON	T. 11 S., Rs. 14, 15, 16 and 17 E.	Duchesne	Green River Fm. (Eocene), deltaic facies and Parachute Creek Mbr.	Sandstone and siltstone	Medium-small	5 to 10	Estimate by UGMS, 1972
PARIETTE (Myton Bench, South Myton Bench, Myton)	T. 4 S., Rs. 2 W., 1 and 2 E. (UM); T. 8 S., Rs. 17 and 18 E.	Duchesne and Uintah	Uinta Fm. (Eocene)	Sandstone and siltstone	Large	12 to 15	Estimate by UGMS, 1972
P. R. SPRING (Peor Springs, Dragon-Asphalt Wash, Sheep Canyon, Roan Cliffs, Evacuation Creek)	Ts. 12 thru 17 S., Rs. 21 thru 26 E.	Uintah and Grand	Green River Fm. (Eocene), Douglas Creek Mbr. and Parachute Creek Mbr. (very minor)	Sandstone and siltstone	Giant	4,000 to 4,500 2,500 m 1,200 i remainder i/c	Byrd, 1970, combined with estimate by UGMS, 1972
RAVEN RIDGE	Ts. 6 and 7 S., Rs. 24 and 25 E.	Uintah	Green River Fm. (Eocene), Douglas Creek Mbr. (minor) and Parachute Creek Mbr.	Sandstone and siltstone	Large	75 to 100	Estimate by UGMS, 1976
RIM ROCK (Northwest Raven Ridge)	T. 6 S., R. 24 E., Secs. 22, 23, 25 and 26	Uintah	Wasatch Fm. (Eocene) and basal Green River Fm. (Eocene)	Sandstone	Large	25 to 30	Estimate by UGMS, 1968, 1978
SPLIT MOUNTAIN (Red Wash)	T. 4 S., R. 23 and 24 E. Thru SE¼ of twp.	Uintah	Park City Fm. (Permian)	Limestone	Minor	-	Estimate by UGMS, 1968, 1972
SPRING BRANCH	T. 2 N., R. 3 W. (UM), NE NE Sec. 24	Duchesne	Duchesne River Fm. (Eocene)	Sandstone and conglomerate	Medium-small	1.5 to 2	Estimate by UGMS, 1972
SPRING HOLLOW	T. 6 S., R. 23 E., ½ Sec. 18	Uintah	Duchesne River Fm. (Eocene)	Sandstone	Minor	-	Estimate by UGMS, 1968, 1978
SUNNYSIDE (Tidwell, Rideout)	Ts. 12, 13 and 14 S., Rs. 13, 14 and 15 E.	Carbon	Upper Wasatch Fm. (Eocene) and basal Green River Fm. (Eocene)	Sandstone and siltstone	Giant	3,500 to 4,000 1,250 m 1,750 i remainder i/c	Holmes, Page and Averitt, 1948; Holmes and Page, 1956; Ball Associates, 1965; combined with estimate of UGMS, 1972 and contributed data.
TABIONA (North Tabiona)	T. 1 S., R. 7 W. (UM), SE Sec. 16 and SW ¼ Sec. 17	Duchesne	Current Creek Fm. (Paleocene- Eocene) and Duchesne River Fm. (Eocene)	Sandstone	Medium-small	4.6 1.3 m 1.6 i 1.7 i/c	Estimate by UGMS, 1972
THISTLE (Oil Hollow)	Ts. 9 and 10 S., Rs. 4 and 5 E.; T. 9 S., R. 4 E., Secs. 26, 27 and 28; T. 10 S., R. 4 E., Secs. 3, 4, 9 and 10; T. 10 S., R. 5 E., Sec. 28	Utah	Green River Fm. (Eocene)	Sandstone with some oolitic and coquina limestone	Medium-small	2.2 to 2.5	Estimate by UGMS, 1972
UPPER KANE HOLLOW	T. 6 S., R. 23 E., Secs. 13 and 24	Uintah	Green River Fm. (Eocene)	Sandstone	Minor	-	Estimate by UGMS, 1972
WHITEROCKS	T. 2 N., R. 1 E. (UM), Secs. 17, 18 and 19	Uintah	Navajo Ss. (Jurassic)	Sandstone	Very large	65 to 125 50 m 15 i remainder i/c	Severy, 1943; Covington, 1963, 1964a and b, 1965; combined with estimate by UGMS and contrib- uted data
WILLOW CREEK (Argyle Canyon)	T. 11 S., Rs. 9 and 10 E.; Ts. 6 and 7 S., Rs. 8 and 9 W. (UM)	Duchesne, Utah and Wasatch	Green River Fm. (Eocene)	Sandstone and siltstone with limestone	Large	10 to 15	Estimate by UGMS, 1978
CENTRAL SOUTHEAST							
BENNETTS SEEP	T. 40 S., R. 10 E. Section not certain (Submerged by Lake Powell)	Kane	Moenkopi Fm. (Triassic)	Sandstone	Minor	-	UGMS estimate, 1969
BLACK DRAGON (Black Box, Jackass Bench)	T. 21 S., Rs. 12, 13 and 14 E.; T. 22 S., R. 13 E.	Emery	Moenkopi Fm. (Triassic)	Sandstone	Very large	100 to 125	UGMS estimate, 1972
CHUTE CANYON (San Rafael Swell, South group)	Ts. 24 and 25 S., Rs. 10 and 11 E.	Emery	Moenkopi Fm. (Triassic)	Sandstone	Large	50 to 60	UGMS estimate, 1972
CIRCLE CLIFFS, EAST FLANK (Wagon Box Mesa)	T. 33 S., R. 8 E.; T. 34 S., Rs. 7 and 8 E.; Ts. 35 and 36 S., Rs. 8 and 9 E.	Garfield	Moenkopi Fm. (Triassic)	Sandstone and siltstone	Giant	860 420 m 340 i 100 i/c	UGMS estimate, 1970
CIRCLE CLIFFS, WEST FLANK	T. 34 S., Rs. 6 and 7 E.; T. 35 S., Rs. 7 and 8 E.	Garfield	Moenkopi Fm. (Triassic)	Sandstone and siltstone	Very large	447 287 m 90 i 70 i/c	UGMS estimate, 1970
COTTONWOOD DRAW	T. 21 S., Rs. 11 and 12 E.	Emery	Moenkopi Fm. (Triassic)	Sandstone, siltstone and minor limestone	Large	75 to 80	UGMS estimate, 1972
FAMILY BUTTE (San Rafael Swell, South group)	T. 22 S., R. 11 E.; Ts. 23 and 24 S., Rs. 9, 10 and 11 E.	Emery	Moenkopi Fm. (Triassic)	Sandstone	Very large	100 to 125	UGMS estimate, 1972
FLAT TOP (San Rafael Swell, South group)	T. 24 S., R. 11 E., Secs. 32 and 33	Emery	Mosback Ss. Mbr. of Chinle Fm. (Triassic)	Sandstone	Minor	.25 to .50	UGMS estimate, 1967 and 1972
JUSTENSEN FLAT (Copper Globe)	T. 23 S., R. 9 E., E½ Sec. 10 and Secs. 16, 20 and 21	Emery	Navajo Ss. and Kayenta Fm. (Jurassic)	Sandstone	Minor	-	UGMS estimate, 1972
MULEY TWIST (Bob Sead)	T. 35 S., R. 8 E., Sec. 10	Garfield	Shinarump Mbr. of Chinle Fm. (Triassic)	Sandstone	Minor	-	UGMS estimate, 1967
POISON SPRING CANYON	T. 31 S., R. 13 E., Secs. 23 and 24	Garfield	Moenkopi Fm. (Triassic)	Sandstone	Medium-small	1.0 to 1.2	UGMS estimate, 1968
RED CANYON (Woodward Wash)	Ts. 20 and 21 S., Rs. 10, 11 and 12 E.; T. 21 S., R. 13 E.	Emery	Moenkopi Fm. (Triassic)	Sandstone	Large	60 to 80	UGMS estimate, 1972
SALT WASH	T. 22 S., R. 16 E., NW Sec. 25; T. 22 S., R. 17 E., Secs. 33, 34 and 35; T. 23 S., R. 17 E., Secs. 2, 3, 11, 14, 23 and 24	Grand	Salt Wash Mbr. of Morrison Fm. and Entrada Ss. (Jurassic)	Sandstone	Minor	.20 to .25	UGMS estimate, 1967 and 1970
SAN RAFAEL SWELL, miscellaneous localities, unnamed (San Rafael Swell, South group)	T. 24 thru 26 S., R. 9 E.	Emery	Mosback Mbr. of Chinle Fm. (Triassic) and Kaibab Ls. (Permian)	Sandstone, limy sand- stone, sandy limestone and limestone	Minor	-	UGMS estimate, 1972
SWEETWATER DOME	T. 26 S., R. 14 E., Secs. 33 and 34	Emery	Curtis Fm. and Entrada Ss. (Jurassic)	Sandstone	Minor	10 to 12	UGMS estimate, 1967
TAR SAND TRIANGLE including ELATERITE BASIN, FAULT POINT, HATCH CANYON, RED COVE, TEAPOT ROCK and THE COVE areas (Cove, Fiddler Cove Canyon, French Seep, North Hatch Canyon, Orange Cliffs, South Hatch Canyon)	Ts. 29, 30, 30½, 31, 32 and 33 S., Rs. 14, 15, 16 and 17 E.	Garfield and Wayne	ELATERITE BASIN White Rim FAULT POINT Cedar Mesa and White Rim HATCH CANYON Moenkopi, basal, White Rim and Shinarump RED COVE White Rim and Cedar Mesa TEAPOT ROCK White Rim and Cedar Mesa THE COVE White Rim, Moenkopi, Basal, and Shinarump White Rim and Cedar Mesa are sandstone members of Cutler Fm. (Permian) Moenkopi Fm. (Triassic) Shinarump Conglomerate is basal member of Chinle Fm. (Triassic)	Sandstone and conglomerate	Giant	12,500 to 16,000 ² 2,300 m 3,800 i 6,400 to 9,900 i/c	Covington, 1965; Schick, 1966; Bowman, 1969a and b; Ritzma, 1969; UGMS estimate 1972
TAR SAND TRIANGLE minor occurrences, unnamed	Ts. 32½ and 33 S., Rs. 14 and 15 E.	Garfield	White Rim Sandstone Mbr. of Cutler Fm. (Permian)	Sandstone	Medium-small	3 .5 m 1.0 i 1.5 i/c	Bowman, 1969a and b; UGMS estimate, 1972
TEASDALE, miscellaneous localities, unnamed (Capitol Reef, Miners Mountain)	T. 29 S., R. 6 E.; T. 30 S., Rs. 6 and 7 E.	Wayne	Moenkopi Fm. (Triassic) and Kaibab Ls. (Permian)	Sandstone, limy sand- stone and limestone	Minor	-	UGMS estimate, 1967 and 1972
TEMPLE MOUNTAIN (San Rafael Swell, South group)	Ts. 24 and 25 S., R. 11 E.	Emery	Mosback Mbr. of Chinle Fm. (Triassic) and Wingate Ss. (Triassic)	Sandstone	Minor	-	UGMS estimate, 1967
TEN MILE WASH	Ts. 23 and 24 S., Rs. 18 and 19 E.	Grand	Burro Canyon Fm. (Cretaceous), Brushy Basin and Salt Wash Mbrs. of Morrison Fm. (Jurassic), Moab Ss. Tongue and main body of Entrada Ss. (Jurassic)	Sandstone	Medium-small	6 1.5 m 2.0 i 2.5 i/c	UGMS estimate, 1970
THOUSAND LAKE MOUNTAIN	T. 28 S., R. 4 E., NE SE Sec. 10	Wayne	Navajo Ss. (Jurassic)	Sandstone	Minor	-	UGMS estimate, 1971
WHITE CANYON	Ts. 34 and 35 S., Rs. 15 and 16 E.	San Juan	Hoskinni Mbr. of Cutler Fm. (Permian)	Sandstone	Large	12 to 15	UGMS estimate, 1972
WHITE CANYON FLAT	T. 33 S., R. 7 E., Secs. 35 and 36	Garfield	Shinarump Mbr. of Chinle Fm. (Triassic)	Sandstone	Medium-small	2.8 1.8 m .4 .6 i/c	UGMS estimate, 1970
WICKIUP	Ts. 21 and 22 S., Rs. 10 and 11 E.	Emery	Moenkopi Fm. (Triassic)	Sandstone, siltstone and minor limestone	Large	60 to 75	UGMS estimate, 1972
OTHER AREAS							
GOULD RANCH	T. 42 S., R. 13 W. E½ Sec. 12	Washington	Timpepaw Mbr. of Moenkopi Fm. (Triassic)	Calcarenite (limestone)	Minor	-	Blakey, in press; UGMS estimate, 1978
HURRICANE CLIFFS	T. 42 S., R. 13 W., Secs. 27 and 34	Washington	Timpepaw Mbr. of Moenkopi Fm. (Triassic)	Limestone	Minor	-	Blakey, in press UGMS estimate, 1978
MEXICAN HAT	Ts. 41 and 42 S., Rs. 17, 18 and 19 E.	San Juan	Rico Fm. (Pennsylvanian- Permian); Hermosa Fm. (Pennsylvanian)	Limestone and sandy limestone	Medium-small	.4 to .5	UGMS estimate, 1972
NORTH CREEK	T. 41 S., R. 11 W. NW¼ Sec. 6	Washington	Upper Mbr. of Moenkopi Fm. (Triassic)	Sandy shale, shale	Minor	-	Blakey, in press; UGMS estimate, 1978
ROZEL	T. 8 N., R. 7 W., Secs. 8, 9 and 16	Box Elder	Lake sediments (Recent)	Oolitic mud, salt	Minor	-	UGMS estimate, 1972
TIMPEPAW CANYON (Virgin River)	T. 41 S., R. 12 W. Secs. 19, 20, 21 and 28	Washington	Timpepaw Mbr. of Moenkopi Fm. (Triassic)	Calcarenite (limestone)	Medium small	0.5 to 1.0	Blakey, in press; UGMS estimate, 1978

UTAH GEOLOGICAL AND
MINERALOGICAL SURVEY
MAP 47, SHEET 2

CHANGES IN NOMENCLATURE OF DEPOSITS
From Map 25 (1968) to Map 33 (1973)

UINTA BASIN

NEW DEPOSITS

Cottonwood-Jacks Canyon
Cow Wash
Daniels Canyon
Minnie Maud Creek—formerly part of Argyle Canyon
Nine Mile Canyon
Thistle
Willow Creek—formerly part of Argyle Canyon

RENAMED DEPOSITS

Lake Fork—formerly Lake Fork-Yellowstone
Littlewater Hills—formerly Deep Creek Nose
Pariette—formerly Myton Bench
Split Mountain—formerly Red Wash

NAMES ABANDONED

Deep Creek Nose—changed to Littlewater Hills
Dragon-Asphalt Wash—combined with P.R. Spring
Lake Fork-Yellowstone—changed to Lake Fork
Myton Bench—changed to Pariette
Red Wash—changed to Split Mountain

DEPOSITS ELIMINATED

Starr Flat—not found
Whiterocks, South—not found

CENTRAL SOUTHEAST

NEW DEPOSITS

Black Dragon—expansion of Black Box
Chute Canyon
Circle Cliffs, East Flank—formerly part of Circle Cliffs
Circle Cliffs, West Flank—formerly part of Circle Cliffs
Cottonwood Draw
Family Butte
Justensen Flat
Red Canyon—expansion of Woodward Wash
Thousand Lake Mountain
Wickiup

RENAMED DEPOSIT

Tar Sand Triangle—includes six formerly separate deposits

NAMES ABANDONED

Black Box—incorporated into Black Dragon
Circle Cliffs—east and west flanks considered separate
Cove, The—area within Tar Sand Triangle
Elaterite Basin—area within Tar Sand Triangle
Fault Point—area within Tar Sand Triangle
Hatch Canyon—area within Tar Sand Triangle
Tar Cliffs—area within Tar Sand Triangle
Teapot Rock—area within Tar Sand Triangle
Woodward Wash—incorporated into Red Canyon

From Map 33 (1973) to Map 47 (This Publication)

OTHER AREAS

NEW DEPOSITS

Gould Ranch
Hurricane Cliffs
North Creek
Timpepaw Canyon—formerly Virgin River

NAMES ABANDONED

Virgin River—area within Timpepaw Canyon

DEPOSITS ELIMINATED

Hurricane Fault—not found

Percent Sulfur in Oils Extracted from Oil-Impregnated Rock

Deposit	No. of Samples	Percent	
		Range	Average
UINTA BASIN			
DEPOSITS IN TERTIARY ROCKS			
Argyle Canyon	2	0.25-0.35	0.30
Asphalt Ridge	2	0.62-0.76	0.69
Chapita Wells	3	0.28-0.87	0.60
Cow Wash	1	-	0.39
Hill Creek	2	0.25-0.40	0.32
Lake Fork	2	0.44-0.46	0.45
Littlewater Hills	1	-	0.41
Pariette	1	-	0.30
P.R. Spring (Wood and Ritzma, 1972)	8	0.33-0.45	0.43
P.R. Spring (Gwynn, 1971, p. 71)	34	0.22-0.42	0.33
Raven Ridge (Wood and Ritzma, 1972)	2	0.27-0.43 ¹	0.35
Raven Ridge (S. Quigley, unpublished)	13	0.12-0.38	0.22
Rim Rock	4	0.33-0.43	0.39
Spring Branch	2	0.47-0.82	0.64
Spring Hollow	1	-	0.76
Sunnyside	2	0.50-0.60	0.55
Tabiona	3	0.20-0.29	0.23
Thistle	1	-	1.07
Upper Kane Hollow	1	-	0.32
DEPOSITS IN MESOZOIC ROCKS²			
Asphalt Ridge (U. Cret.)	4	0.19-0.39	0.29 ²
Asphalt Ridge, Northwest (U. Cret.)	2	0.35-0.40	0.38 ²
Whiterocks (Jurassic)	3	0.41-0.48	0.45 ²
DEPOSITS IN PALEOZOIC ROCKS			
Daniels Canyon (Perm.-Penn.) ³	1	-	0.62 ³
Split Mountain (Perm.) ³	1	-	2.94 ³
CENTRAL SOUTHEAST			
DEPOSITS IN JURASSIC ROCKS			
Salt Wash	1	-	2.16
Ten Mile Wash	1	-	4.16
Thousand Lake Mountain	1	-	4.48
DEPOSITS IN TRIASSIC ROCKS			
Black Dragon	5	2.84-5.08	3.82
Circle Cliffs, East Flank	1	-	3.63
Circle Cliffs, West Flank	5	2.37-4.19	3.36
Cottonwood Draw	2	1.64-3.22	2.43
Family Butte	2	3.46-3.65	3.56
Muley Twist	2	3.82-4.09	3.96
Red Canyon	1	-	2.57
White Canyon Flat	3	3.02-3.91	3.49
DEPOSITS IN PERMIAN ROCKS			
Tar Sand Triangle	15	2.67-6.27	3.56