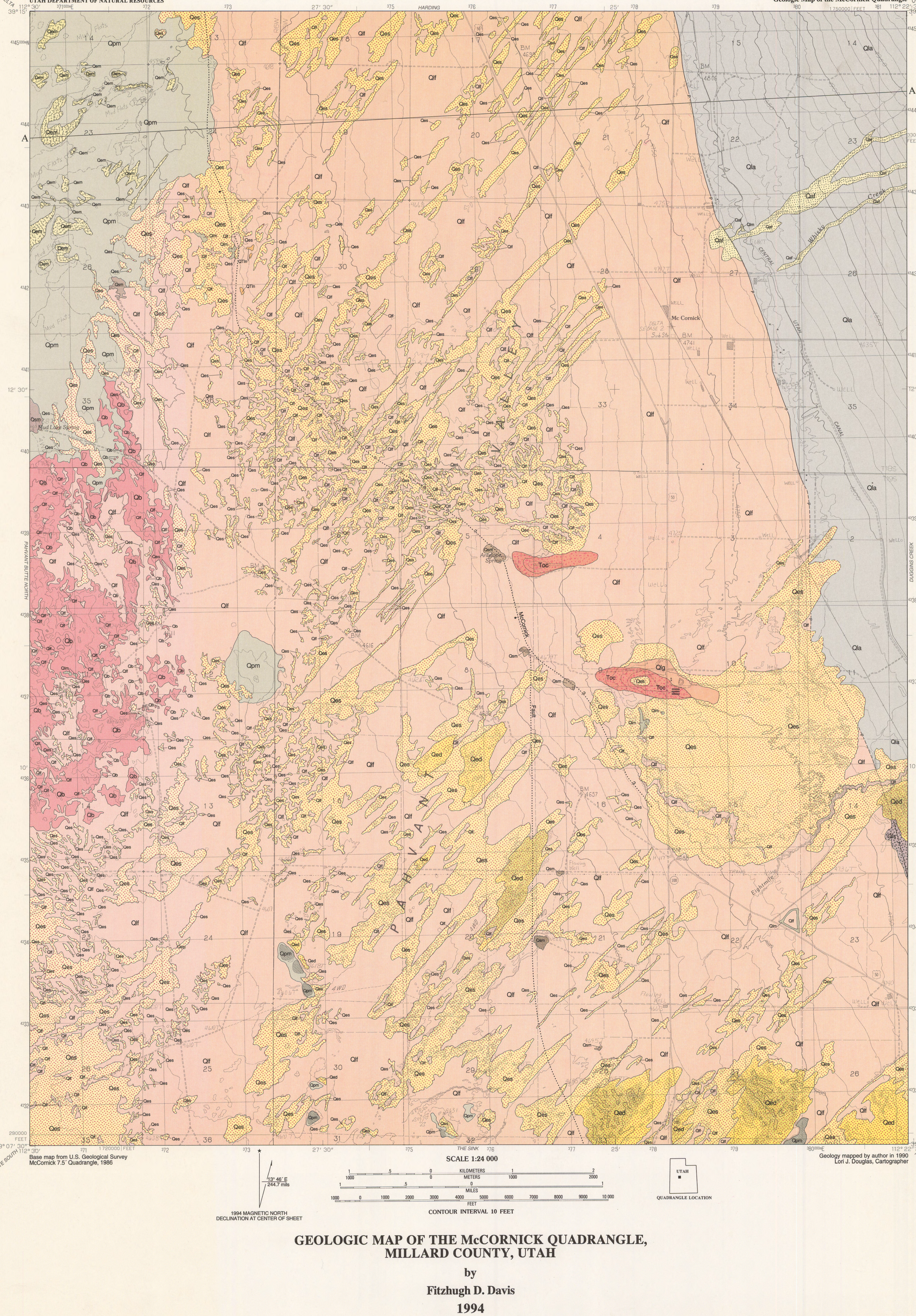
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Plate 1
Utah Geological Survey Map 165
Geologic Map of the McCornick Quadrangle



Base map from U.S. Geological Survey
McCornick 7.5′ Quadrangle, 1986

Geology mapped by author in 1990
Lori J. Douglas, Cartographer

13° 46′ E
244.7 mils
1994 MAGNETIC NORTH
DECLINATION AT CENTER OF SHEET

SCALE 1:24 000

1 .5 0 KILOMETERS 1 2
1000 0 METERS 1000 2000
1 .5 0 MILES 1
1000 0 1000 2000 3000 4000 5000 6000 7000 8000 9000 10 000 FEET

CONTOUR INTERVAL 10 FEET

QUADRANGLE LOCATION

GEOLOGIC MAP OF THE McCORNICK QUADRANGLE, MILLARD COUNTY, UTAH

by

Fitzhugh D. Davis

1994

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Plate 2
Utah Geological Survey Map 165
Geologic Map of the McCornick Quadrangle

DESCRIPTION OF MAP UNITS

Qaf — Alluvial-fan deposits - *Poorly sorted coarse- to fine-grained alluvium of Whisky Creek and an unnamed stream north of Whisky Creek. The alluvium is largely flood deposits of silt, fine sand, and clasts of quartzite and limestone. The unnamed creek has deposited a small alluvial fan at the Provo shoreline. These deposits are 1 to 5 feet (0.3 - 1.5 m) thick.*

Qed — Eolian dunes - *Active and morphologically well-developed sand dune fields. Barchanoid ridges, barchans, and transverse dunes are common where the sand supply is abundant. The dunes consist of tan, silty, fine sand that is not stabilized by vegetation. The sand is well sorted and about 80 percent clear to white, mostly frosted quartz grains. The remaining 20 percent consists of feldspar, calcite, pyroxene, and magnetite grains as well as red and green quartz. The dunes range from 3 to 32 feet (0.9 - 9.8 m) high.*

Qes — Eolian sand - *Windblown sand in sheets, irregular mounds, shrub-coppice dunes, and narrow northeast-trending ridges that are stabilized by vegetation. These landforms are 1 to 8 feet (0.3 - 2.4 m) high. The sand size and composition is the same as for Qed. The black volcanic ash content of the sand increases westward in the quadrangle, and adjacent to the basalt outcrops it is largely black, sand-sized ash.*

Qem — Eolian mud - *Light-gray, non-stratified, calcareous, windblown mud that forms barchan dunes and irregularly shaped lunettes that are 4 to 10 feet (1.2 - 3 m) high in the playa area in the northwestern part of the quadrangle. The mud is a windblown dust from adjacent playas that contains abundant, minute, white and clear gypsum and calcite concretions.*

Qpm — Playa mud - *Laminated, light-gray, very calcareous and gypsiferous clay, silt, and fine sand. Silt laminations are predominant. Some playas have a thin white or tannish-white alkali crust. The playa mud is probably 5 to 10 feet (1.5 - 3 m) thick.*

Qsm — Marsh deposits associated with springs - *Gray to black organic mud in marshy areas. Probably 2 to 5 feet (0.6 - 1.5 m) thick.*

Qla — Lacustrine and alluvial deposits undifferentiated - *Reworked alluvium that ranges from a tan sandy silt to a tan silty and gravelly fine sand. Holocene alluvium covers the lacustrine deposits in some places. Exposures range from 1 to 4 feet (0.3 - 1.2 m) thick.*

Qls — Lacustrine sand - *Tan, pebbly, fine- to coarse-grained sand that forms the Provo shoreline beach ridge in the southeast part of the quadrangle. The sand is poorly cemented by $CaCO_3$. The shoreline ridge is 2 to 4 feet (0.6 - 1.2 m) thick.*

Qlm — Lacustrine marl - *Fine-grained, thinly bedded to indistinctly laminated, white to light-gray, offshore to deep-water marl biochemically deposited in Lake Bonneville. Ostracodes are abundant throughout the unit. Exposures range in thickness from 2 inches (5 cm) to 4.25 feet (1.3 m).*

Qlf — Fine-grained lacustrine sediments - *Grayish-tan, tan, and light-gray calcareous silts are the main deep-water sediments of Lake Bonneville. This unit also includes reworked lacustrine marl and other sediments that were washed downslope during the regressive phase of Lake Bonneville. There are no vertical exposures, but the thickness is probably 10 feet (3 m) or less.*

Qb — Basalt - *Alkali olivine basalt that is vesicular and weathers dark-brown to black; a fresh surface is medium gray. The basalt is about 70 percent plagioclase, 4 to 6 percent olivine, less than 4 percent augite, and the remainder is groundmass and vugs. Exposures range to 35 feet (10.7 m) high.*

Qlg — Lacustrine gravel - *Reworked rocks of the Oak City Formation (upper Miocene and Pliocene) that consist of subangular to subrounded pebbles and cobbles of quartzite and limestone with an exposed thickness of 8 feet (2.4 m). The upper part of the gravel deposit has a stage IV calcium carbonate morphology.*

QTln — Pleistocene and Pliocene lacustrine limestone and sandstone - *Light-gray sandy limestone interbedded with light-gray, very calcareous, fine-grained sandstone. All beds are laminated to thin bedded and comprise the nearshore facies of a Plio-Pleistocene lake. The unit is probably 20 to 30 feet (6 - 9 m) thick.*

Toc — Oak City Formation - *Unconsolidated deposits of angular cobbles and boulders of purple, pink, and white quartzite, and gray limestone. Ranges from 140 to 340+ feet (42.7 - 103+ m) thick.*

Tf — Flagstaff Formation - *Not exposed in quadrangle; shown on cross section only; light-gray sparry limestone, 11 feet (3.4 m) thick, possibly an erosional remnant.*

TKn — North Horn Formation - *Shown on cross section only; about 449 feet (137 m) of tan, sandy limestone in upper part of unit; most of remainder is interbedded red, fine- to medium-grained sandstone and gray limestone except for a 70-foot (21 m) thick conglomerate sequence the base of which is 280 feet (85 m) above the base of the formation; total thickness is 1,599 (487 m) feet.*

Sl — Laketown Dolomite - *Shown on cross section only; medium-light-gray to medium-dark-gray, medium-grained thick-bedded to massive dolomite; about 1,100 feet (335 m) thick in the Pavant thrust plate.*

Ofh — Fish Haven Dolomite - *Shown only on cross section; the upper 120 feet (37 m) is light to dark gray, coarsely crystalline dolomite; the lower 70 feet (21 m) is interbedded gray dolomite and white quartzite; total thickness is 190 feet (58 m).*

Oe — Eureka Quartzite - *Shown only on cross section; white, medium-grained quartzite; 60 feet (18 m) thick.*

Op — Pogonip Group - *Shown only on cross section; the upper 1,230 feet (375 m) consists of mottled, light- to dark-gray, coarsely crystalline dolomite with calcite fracture fillings; the lower 260 feet (79 m) is light- to dark-gray limestone with fossil hash; total thickness is 1,490 feet (454 m).*

MAP SYMBOLS

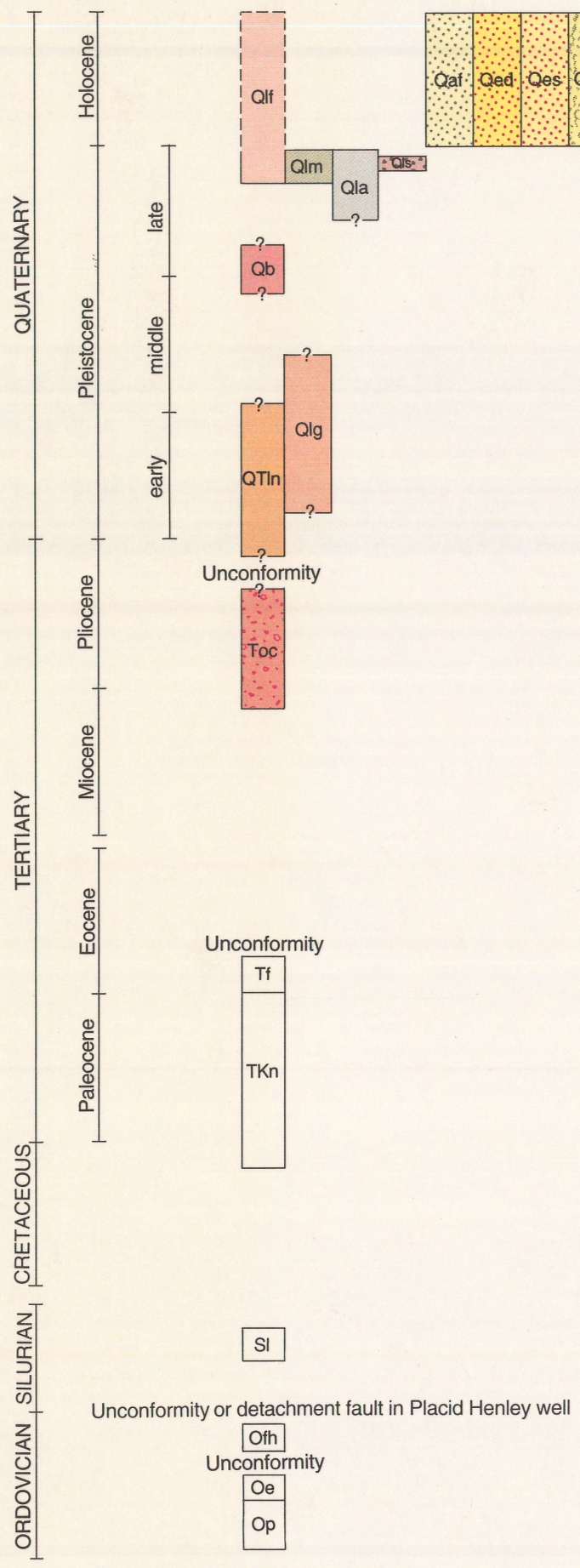
Contact - *Dashed where approximately located; dotted where obscured.*

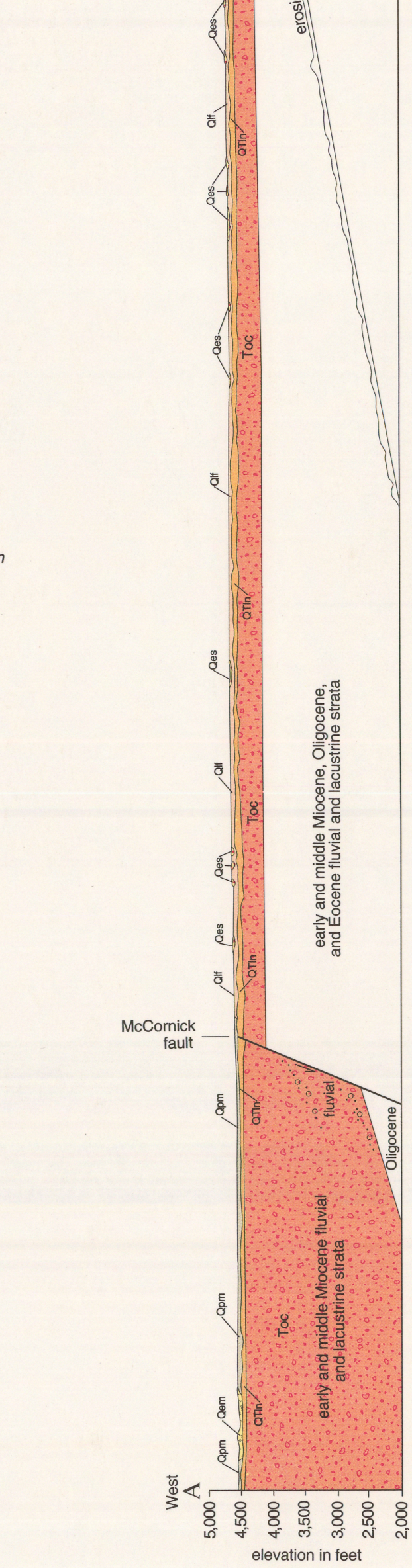
Concealed fault - *Queried where location is uncertain; bar and ball on downthrown side.*

Provo shoreline of Lake Bonneville - *dashed where inferred; dotted where buried.*

Gravel pit

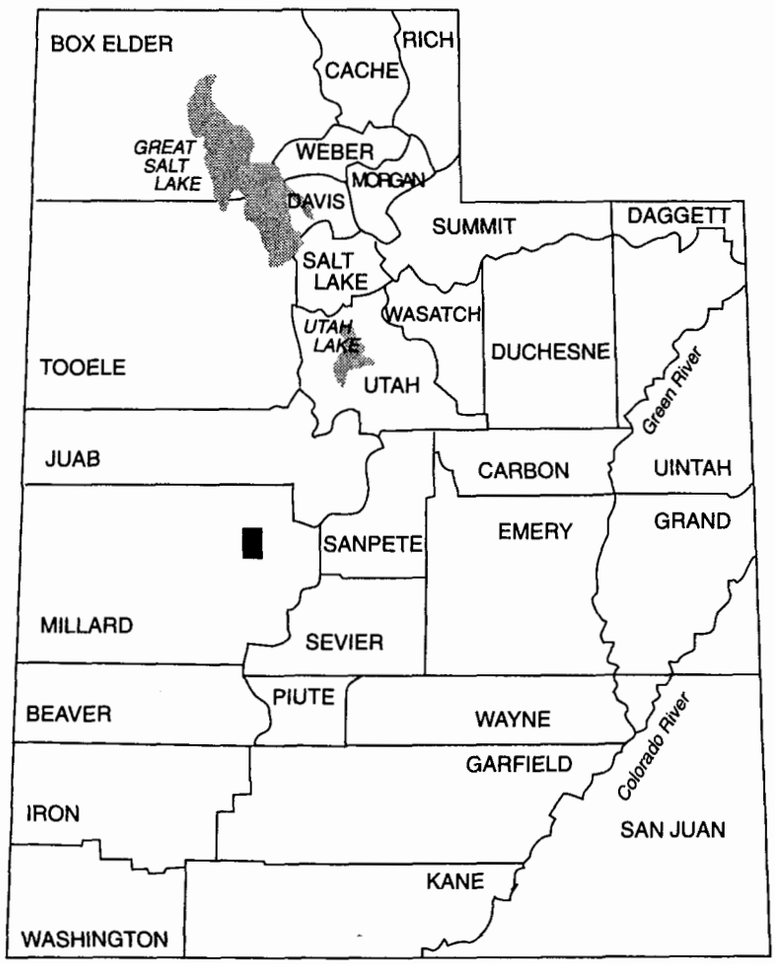
CORRELATION OF MAP UNITS





GEOLOGIC MAP OF THE McCORNICK QUADRANGLE, MILLARD COUNTY, UTAH

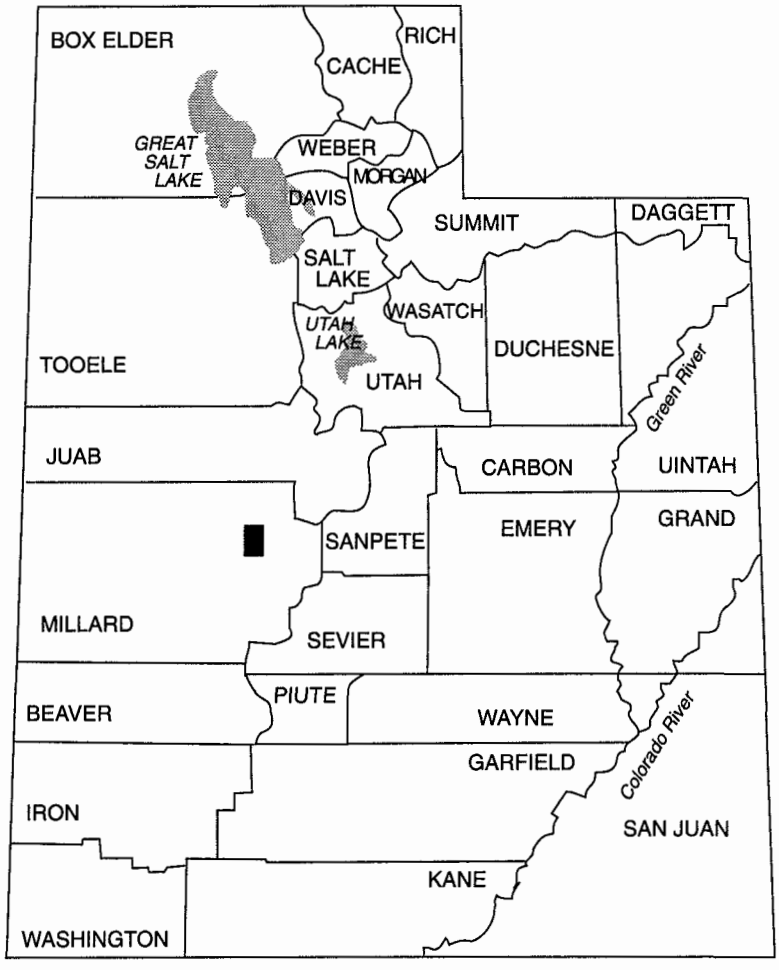
by
Fitzhugh D. Davis
Utah Geological Survey



MAP 165 **1994**
UTAH GEOLOGICAL SURVEY
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GEOLOGIC MAP OF THE McCORNICK QUADRANGLE, MILLARD COUNTY, UTAH

by
Fitzhugh D. Davis
Utah Geological Survey



MAP 165 **1994**
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GEOLOGIC MAP OF THE McCORNICK QUADRANGLE, MILLARD COUNTY, UTAH

by

Fitzhugh D. Davis
Utah Geological Survey

ABSTRACT

The McCornick quadrangle covers an area marginal to the eastern Sevier Desert and the northern part of Pahvant Valley in eastern Millard County, Utah. Deposits ranging in age from late Miocene to late Holocene are exposed in the quadrangle. The Oak City Formation (upper Miocene and Pliocene) is poorly exposed in two knolls in the east-central part of the map area. A thin, nearshore facies of an upper Pliocene to Pleistocene lacustrine unit is exposed in the northwest part of the quadrangle and Pahvant Ridge basalt of late Pleistocene, pre-Lake Bonneville age is present in the western part of the map area. The remainder of the quadrangle is covered by upper Pleistocene Lake Bonneville deposits and Holocene alluvium, eolian sand and mud, and deflation playas.

The only exposed structural feature in the quadrangle is the extensional, down-to-the-west McCornick fault that offsets Quaternary deposits and can be traced from the northwest to the south-central part of the map area. Displacement on the fault is 1,500 to 1,800 feet (450 to 550 m) and movement probably has been repetitive since late Oligocene time. At depth, the fault may sole into the Sevier Desert detachment.

Ground water and sand and gravel are the main geologic resources utilized in the quadrangle. Geologic hazards include potential movement of the McCornick fault, locally poor foundation soils, and windblown sand.

INTRODUCTION

The McCornick quadrangle comprises an area marginal to the eastern Sevier Desert and northern Pahvant Valley in eastern Millard County, Utah (figure 1). Pahvant Valley extends about 32 miles (51 km) in a general north-south direction and averages 8 or 9 miles (13 to 14 km) in width, the north part being a few miles wider. The valley is bounded on the north by the Canyon Mountains, on the east and south by the Pahvant Range, and on the west by a roughly north-south line of volcanoes that include Pahvant Butte, the Ice Springs craters, and Tabernacle Hill. McCornick, in the northeast quarter of the quadrangle, was a siding on the Union Pacific Railroad spur from Delta to Fillmore. The spur was abandoned and dismantled many years ago.

The quadrangle is in the eastern part of the Basin and Range Physiographic Province 2 miles (3 km) southwest of the Canyon Mountains and 9 miles (14 km) west of the Pahvant Range. Pahvant Butte, a basaltic tuff cone 2 miles (3 km) west of the southwest corner of the quadrangle, rises 900 feet (270 m) above a foundation of basalt referred to as Pahvant Ridge. Basalt extends into the western part of the McCornick quadrangle.

The terrain in the western and southern parts of the quadrangle is fairly flat except for rugged basalt outcrops that range to 35 feet (11 m) in height. Low mounds and narrow northeast-trending ridges of windblown fine sand are common. They overlie, and are separated by, fine-grained, deep-water sedi-

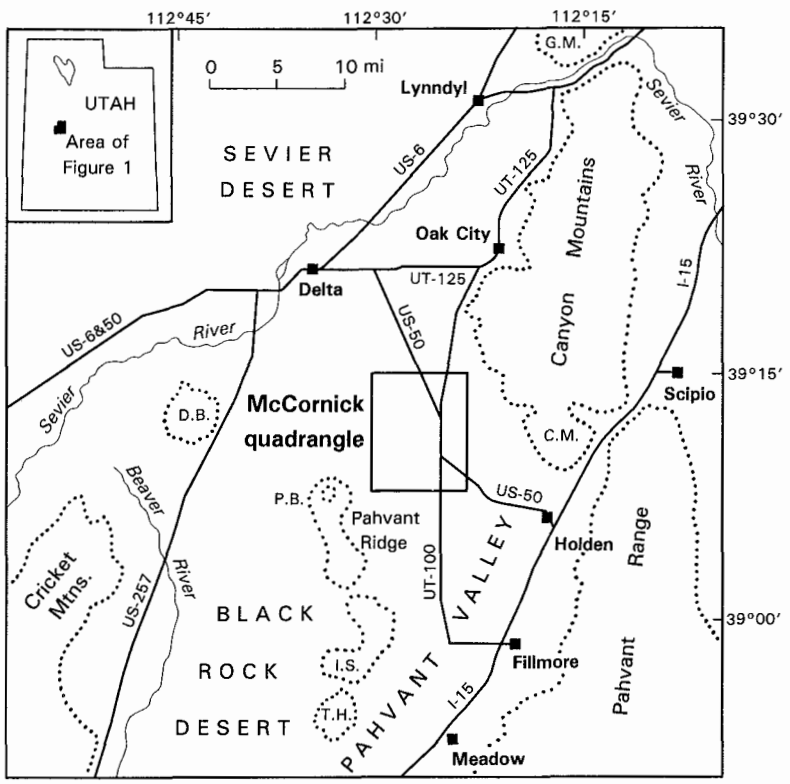


Figure 1. *Index map showing the location and regional setting of the McCornick quadrangle. DB = Deseret basalt flow; G.M. = Gilson Mountains; C.M. = Church Mountains; I.S. = Ice Springs craters and basalt flow; T.H. = Tabernacle Hill Crater and basalt flow; P.B. = Pahvant Butte.*

ments of Lake Bonneville. Seven small, active, sand-dune fields, with well-developed dunes up to 30 feet (9 m) high, are present in the south-central and southeast parts of the quadrangle. A large playa area is present in the northwest part of the quadrangle and six small playas are present in the southwest quadrant. The Provo shoreline of Lake Bonneville extends across the eastern side of the quadrangle. Above this shoreline is the gentle, fairly smooth piedmont slope of the Canyon Mountains. Two intermittent drainages, Whisky Creek to the north and Eightmile Creek to the south, cross the piedmont slope in southwesterly directions. The topographic relief in the quadrangle is 410 feet (125 m) with the lowest place at an elevation of 4,580 feet (1,396 m) along the northwest border and the highest place at an elevation of 4,990 feet (1,521 m) in the northeast corner.

Most of the land in the western half of the quadrangle is administered by the U.S. Bureau of Land Management and is used for cattle grazing. The land in the eastern half of the quadrangle is privately owned, and much of it is cultivated. Average annual precipitation is 8 inches (20 cm) (Peck and Richardson, 1965) and irrigation water is obtained from wells. Access to the quadrangle is by U.S. Highway 50 from the north, U.S. Highway 50 from the east, and Utah Highway 100 from the south. From the junction of U.S. Highway 50 and Utah Highway 100, two dirt roads provide access to the western part of the quadrangle.

Previous geologic work in the vicinity includes that of Gilbert (1890) who described the volcanic rocks of Pahvant Butte, the Ice Springs craters, and Tabernacle Hill, as well as the surrounding Lake Bonneville sediments, shorelines, and land-forms. Dennis and others (1946), in conjunction with ground-water studies, produced the first geologic map of central and southern Pahvant Valley (the northern boundary of their map is 5 miles (8 km) south of the McCornick quadrangle). Maxey (1946) mapped a large part of the Pahvant Range and identified the Pahvant Range thrust fault. Christiansen (1952) mapped the geology of the Canyon Mountains and recognized the Canyon Mountains thrust fault. The first geologic map that included the McCornick quadrangle was compiled by Hintze (1963). Hoover (1974) mapped and reported on the Quaternary volcanism in the Black Rock Desert. Also in 1974, Sayre described the geology and mineralization of the Church Hills at the south end of the Canyon Mountains. The Cenozoic rocks and structural development of the Canyon Mountains were studied by Campbell (1979). Oviatt (1989), and Oviatt and others (1994) mapped and described the Quaternary geology of part of the Sevier Desert. In 1991, Oviatt reported on the Quaternary geology of the Black Rock Desert which is southwest of the McCornick quadrangle.

STRATIGRAPHY

Deposits ranging in age from Miocene to late Holocene are exposed in the McCornick quadrangle. Two knolls in the east-central part of the quadrangle consist of unconsolidated quartzite and limestone boulders that are thought to be upper Miocene to Pliocene landslides, fluvial deposits, and debris flows from the Pahvant Range. A thin lacustrine unit of Plio-Pleistocene age is exposed in the northwest part of the quadrangle, and basalt of late Pleistocene (pre-Lake Bonneville) age is present in the west. The remainder of the quadrangle is covered by upper Pleistocene Lake Bonneville deposits and Holocene alluvium, eolian sand and mud, and playas.

Lake Bonneville was the youngest and deepest of the large Quaternary lakes that occupied the connected valleys of western Utah (Gilbert, 1890). The lake began to rise after about 30,000 years ago in northwestern Utah (Oviatt, 1989). About 20,000 years ago, the lake transgressed southward into the Sevier Desert, Pahvant Valley, and the Black Rock Desert. The lake continued to rise until it overflowed into the Snake River drainage basin in southern Idaho about 15,000 years ago. The Bonneville shoreline was formed during this high stage. The lake

overflowed intermittently until about 14,500 years ago when the alluvial overflow threshold failed catastrophically and released a flood. The flood lowered the lake level approximately 350 feet (107 m) to a stabilized bedrock threshold, and the Provo shoreline was formed during continued overflow between about 14,500 and 14,200 years ago (Burr and Currey, 1988). After the latter date, the lake dropped below its overflow threshold and began to contract as a closed-basin lake. About 12,000 years ago, the regressing Lake Bonneville in the Great Salt Lake basin became separated from Lake Gunnison in the Sevier Desert basin (Oviatt 1989, p. 33). Lake Gunnison had a smaller surface area relative to inflow volume and maintained a positive water balance compared to the rapidly regressing Lake Bonneville to the north. Lake Gunnison overflowed continuously into Lake Bonneville until about 10,000 years ago. At that time, Lake Gunnison regressed to the floor of Sevier Lake playa (west of the Cricket Mountains).

Oviatt's (1989, 1991) scheme of mapping Quaternary deposits, based on their environments of deposition, is used in this report.

Upper Miocene and Pliocene Deposits

Oak City Formation (Toc)

This unit is poorly exposed in two knolls of small relief in the east-central part of the quadrangle. These knolls are piles of unsorted, angular, unconsolidated pebbles, cobbles, and boulders of quartzite and limestone (figure 2). The quartzite colors are white, brown, pink, purple, and purple and pink banded. Limestone cobbles and boulders are shades of gray. Lehi F. Hintze (verbal communication, 1990) stated that these rocks probably were derived from the Cambrian and other Paleozoic strata in the Pahvant Range.

The knolls are covered with a mantle of cobbles and boulders (up to 2 feet [0.6 m] in size) that make digging very difficult. The nature of the matrix is unknown. The poor sorting, the size and angularity of the rocks, and the distance to the Pahvant Range (about 11 miles [17 km]) suggest that the deposit consists of debris flows and flash flood, fluvial deposits. Similar deposits underlie eastern parts of the quadrangle. Five water well logs from the northeast part of the quadrangle show that these gravel and boulder deposits range from 140 feet (43 m) to more than 340 feet (104 m) thick (Mower, 1963, p. 13). The deposits are found at various depths and possibly thicken westward. They are being exhumed by erosion in the footwall of a Quaternary normal fault that moved down to the west. The knoll in the SE¼ section 9, T. 19 S., R. 5 W. has a relief of 45 feet (14 m) and the knoll in the SW¼ section 4, T. 19 S., R. 5 W. has a relief of 30 feet (9 m).

In 1946, Maxey (p. 340) described a fanglomerate that crops out along the west front of the Pahvant Range in creek beds and in various hills that project above the general level of the alluvial apron. The fanglomerate consists of angular, poorly sorted pebbles, cobbles, and boulders ranging from ½ inch (1 cm) to 4 feet (1 m) in diameter that are cemented with pink and reddish-orange calcareous sand, silt, and clay. The fanglomerate is well-consolidated relative to the alluvial fans that are deposited over and around it. Maxey did not report a thickness, but Dennis and others (1946, p. 28) estimated a thickness of 800+ feet (240+ m). Maxey (1946, p. 341) tentatively assigned the fanglomerate a late Pliocene or early Pleistocene age and called it the Sevier River Formation.

Campbell (1979, p. 8) described a similar fanglomerate on the west side of the Canyon Mountains. Clast lithologies are mainly quartzite with subordinate limestone and minor amounts



Figure 2. *Angular quartzite and limestone boulders of the Oak City Formation. Hammer for scale.*

of sandstone and conglomerate. The matrix is pink, silty, very calcareous sandstone. Campbell estimated that the fanglomerate is 1,600 feet (490 m) thick, but was originally thicker with an unknown amount removed by erosion. Based chiefly on structural and physiographic evidence, Campbell reasoned that the fanglomerate was Miocene in age. On the basis of relative age, geomorphology, and lithologic characteristics, he could not correlate the unit with the Sevier River Formation and named it the Oak City Formation.

Hintze (1991, unpublished information) mapped fanglomerates in eastern Millard County similar to those mapped by Maxey and Campbell as the Oak City Formation. The age has been refined from previous estimates. Oviatt (1991, p. 8) found the Cudahy Mine ash, 2.2 to 2.6 million years old, interbedded with coarse alluvium in the upper part of the Oak City Formation exposed in a road cut along Interstate Highway 15 (NW¼NE ¼ section 26, T. 24 S., R. 7 W.) in Baker Canyon. Therefore, the fanglomerates referred to as the Oak City Formation were probably deposited from late Miocene through Pliocene time.

Upper Pliocene and Pleistocene Rocks

Lacustrine limestone and sandstone (QTln)

Light-gray, sandy limestone interbedded with light-gray, very calcareous, fine-grained sandstone is poorly exposed in three places in the footwall slope of a Quaternary normal fault in the E½ section 25, T. 18 S., R. 6 W. (figure 3). The rocks are well indurated and bedding is laminated to 4 inches (10 cm) thick. The bedding appears to be essentially horizontal. The sand grains are mostly clear quartz, but other mineral grains are present. All are subangular to rounded. Outcrops of QTln on the footwall slope are scattered, poorly exposed, and 20 to 30 feet (6 to 9 m) thick. Neither the base nor the top of the unit are exposed, but the unit probably unconformably overlies the Oak City Formation and is overlain by Lake Bonneville sediments. Presumably, erosion has removed QTln from the two knolls of Oak City Formation.

QTln is the shore and nearshore facies of a late Pliocene to earliest middle Pleistocene lake or intermittent lake (Oviatt, 1991, p. 8). QTln and its time equivalent, deeper water, fine-grained facies of the lake have been mapped by Oviatt (1989, 1991) and Oviatt and others (1994) over large areas in the Sevier and Black Rock Deserts of Juab and Millard Counties. The fine-grained facies are not exposed in the McCornick quadrangle.

The age of these lake beds is broadly constrained by two ashes. The Huckleberry Ridge ash (2.02 million years, Izett and Wilcox, 1982) is contained in silty lacustrine deposits mapped as the fine-grained facies by Oviatt (1991, p. 8) on the east side of the Cricket Mountains. On the western shore of Sevier Lake, the Bishop ash (0.74 million years, Izett, 1982) is interbedded with the fine-grained facies (Oviatt, 1989, p. 8). This Plio-Pleistocene lake and its deposits are not yet named because the basin boundaries and other parameters are still being determined. The lacustrine deposits have been found as high as 4,850 feet (1,478 m) in several places. Based on an ostracode fauna, the lake had a salinity range of 500 to 2,000 ppm and, thus, the water was fresh to slightly saline (Oviatt, 1989, p. 8).

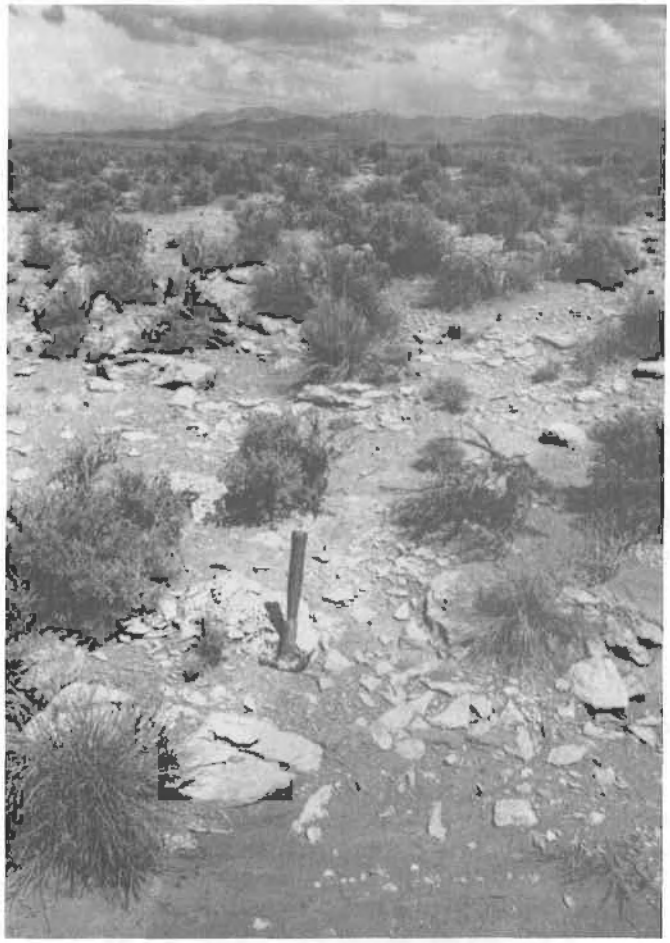


Figure 3. Poorly exposed outcrops of the nearshore facies of a Plio-Pleistocene lake. The rocks consist of light-gray, sandy limestone interbedded with light-gray calcareous sandstone. Hammer for scale. The Canyon Mountains are in the background.

As an added curiosity, on the footwall slope of the Quaternary fault described above, there are thin, scattered patches of ancient Beaver River alluvium that are characterized by well-rounded pebbles of obsidian. This alluvium was deposited on the river floodplain presumably before topographic barriers such as Pahvant Butte were formed. The Beaver River alluvium is too small to map nor is it contained in QTln. The present Beaver River channel is 18 miles (29 km) southwest of these deposits.

Pleistocene Deposits

Lacustrine gravel (Qlg)

Currents and wave action in Pleistocene lakes have broken, comminuted, and reworked rocks of the Oak City Formation. The resulting lacustrine gravel deposit partially surrounds the

knoll of Oak City Formation in the E½ section 9 and the W½ section 10, T. 19 S., R. 5 W. The deposit consists of subangular to subrounded pebbles and cobbles of quartzite and limestone intermixed with sand and silt. The clasts are identical to lithologies found in the Oak City Formation. Eight feet (2.4 m) of the deposit is exposed in two gravel pits.

The west wall of one of these pits (NW¼ SW¼ section 10, T. 19 S., R. 5 W.) exposes calcium carbonate stage IV morphology (Machette, 1985a, p. 5) in the K horizon of a soil profile developed in the gravelly material. The K horizon ranges from 2.2 to 2.5 feet (0.7 to 0.8 m) thick. The $CaCO_3$ is white to light gray and well cemented with some rounded concretions up to ¾ inch (2 cm) in diameter. The upper 10 inches (25 cm) of the horizon is highly laminated with laminations ranging from ¼ inch to 1 inch (0.6 to 2.5 cm) thick (figure 4). The horizon is plugged with 50 to 75 percent $CaCO_3$, and pebbles and cobbles have been thoroughly coated and pushed apart by the accumulation. The K horizon is considered pedogenic because $CaCO_3$-rich ground-water deposits generally lack these characteristics and commonly contain gravel in which there is clast-to-clast contact (Machette, 1985a, p. 7).

Machette (1985b, p. 32) found a K horizon that has stage IV carbonate morphology in the Beaver Basin, 56 miles (90 km) south of the McCornick quadrangle. By various means, including determining the age of a basalt, Machette reasoned that the K horizon was about 750,000 years old. This age estimate is latest early Pleistocene.

The $CaCO_3$ accumulation rate for soils in the McCornick quadrangle is unknown, but it may be slightly faster than in the Beaver Basin. It appears plausible that the K horizon began forming in the Qlg in early middle Pleistocene time or about 650,000 years ago. This suggests that much of the reworking of the high relief parts of the Oak City Formation was accomplished by the QTln lake with only minor modification by subsequent lakes.

Basalt (Qb)

Outcrops of the basalt flow from Pahvant Ridge fissures are present in the western part of the quadrangle (figures 1 and 5). The main mass of basalt forms a fairly horizontal flow the top of which is jagged, undulatory, and, in many places, broken up. Around and adjacent to the perimeter of the flow, the basalt forms low mounds and ridges that are partially covered by Lake Bonneville deposits and Holocene eolian sand. Deep-water sediments (Qlf and Qlm) of Lake Bonneville are found in places on top of the basalt flow. The exposed thickness of the basalt ranges up to 35 feet (11 m). The thickness of the flow is unknown, but a likely range is 40 to 80 feet (12 to 24 m) for the main mass.

The vesicular olivine basalt weathers dark brown to black, and fresh surfaces are medium gray. The basalt is fine grained and plagioclase and olivine form small phenocrysts. The composition is about 70 percent plagioclase, 4 to 5 percent olivine, 2 to 3 percent augite, and the remainder is groundmass and vugs. The vugs are filled with calcite, zeolite, and clays. Hoover (1974, p. 44-46) studied the petrography of this basalt and stated that the plagioclase is subhedral labradorite. Constituents of the groundmass include augite, apatite needles, various oxides, labradorite, and olivine. The groundmass contains abundant, small, partially developed euhedral to subhedral olivine and subhedral labradorite with coreless H-shaped grain outlines that Hoover (1974, p. 46) interpreted as diagnostic of rapid quenching of the basaltic lava. This may indicate eruption into a shallow lake.



Figure 4. *Stage IV calcium carbonate morphology in an early middle Pleistocene lacustrine gravel deposit. Hammer for scale.*

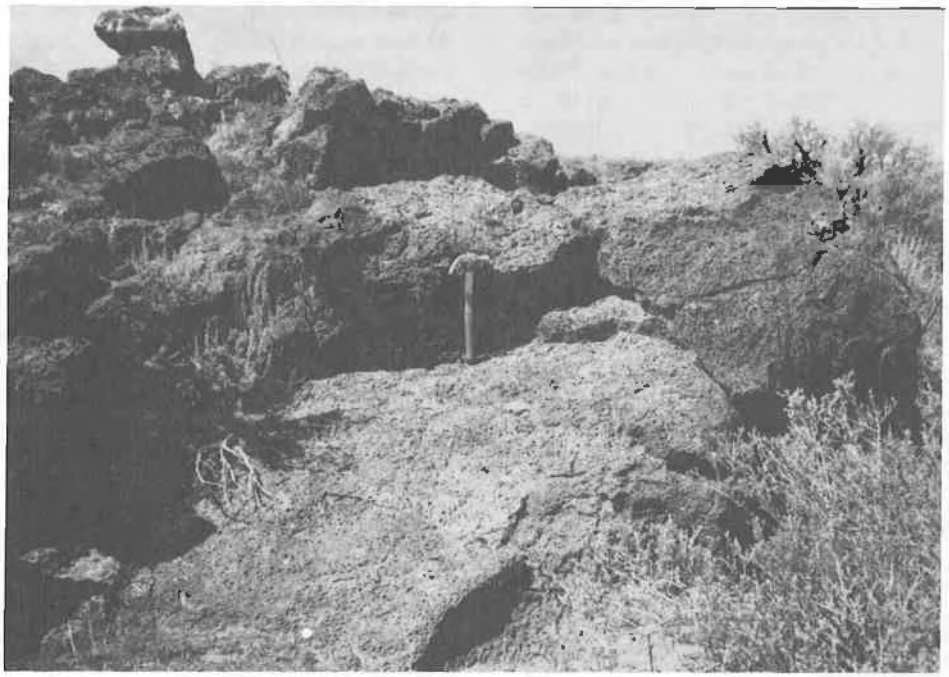


Figure 5. Outcrop of dark-brown to black olivine basalt that flowed from a Pahvant Ridge fissure. Hammer for scale.

Based on chemistry, Hoover (1974, p. 48, figure 14) showed that the initial flow of Pahvant Butte basalt is transitional between the tholeiitic and alkalic suites. Seven whole-rock analyses of the basalt were made by electron microprobe (table 1).

Several workers have obtained K-Ar radiometric ages on the Pahvant Ridge basalt (table 2). The ages have a large degree of uncertainty, but all are late middle or late Pleistocene and pre-Lake Bonneville.

The basaltic tuff cone of Pahvant Butte formed during a subaqueous volcanic eruption into Lake Bonneville (Oviatt, 1989, p. 36). A black basaltic ash from the eruption fell in eastern Millard County and parts of central and eastern Juab County. This ash is especially well-preserved in the deep water, white marl facies (Qlm) of Lake Bonneville and is an important stratigraphic marker for the region. The ash is about 5.8 inches (15 cm) thick and is interbedded with Qlm in the northeastern part of the McCornick quadrangle. The black ash is also a significant component of the eolian sand in the McCornick quadrangle and surrounding areas. Using radiocarbon age estimates, Oviatt (1991, p. 20) determined that the Pahvant Butte ash erupted about 15,500 years ago when Lake Bonneville was about 50 feet (15 m) below the Bonneville shoreline. Oviatt and Nash (1989) sampled and analyzed the ash from ten localities (table 3).

Using Pearce element ratios, Oviatt and Nash (1989, p. 300-301) ascertained that these ashes (table 3) are comagmatic and that the composition of the glasses are consistent with residual liquids derived by differentiation from the magma that supplied the Pahvant Ridge basalt (compare table 1 with table 3).

Lake Bonneville Deposits

Fine-grained lacustrine deposits (Qlf)

Large areas of the McCornick quadrangle are covered by fine-grained sediments of Lake Bonneville. Typically, they are grayish-tan, tan, and light-gray, calcareous, laminated silts. However, in places, especially at higher elevations in the eastern half of the quadrangle, they are fine sandy silts. Also, in many places Qlf and Qlm (marl) are intimately mixed; both are offshore and deep-water sediments of Lake Bonneville. The resultant deposit is either a very calcareous, light-gray silt or a very silty, light-gray marl. Where Qlf and Qlm are indistinguishable, the deposit is mapped as Qlf. In still other places, eroded and reworked marl has been washed into Qlf. There are no vertical exposures of Qlf, but the thickness is probably 10 feet (3 m) or less. The deposits are late Pleistocene in age.

Lacustrine marl (Qlm)

Outcrops of Qlm are small and scattered across the quadrangle. Qlm consists of fine-grained, thinly bedded to indistinctly laminated, white to light-gray, offshore to deep-water, biochemically precipitated marl and variable amounts of detrital sediment. Ostracodes are abundant throughout the unit and gastropods are locally numerous near the base and top. Oviatt (1989, p. 10) reported that in the Sevier Desert Qlm was deposited from about 20,000 years ago to about 12,000 years ago. In the McCornick

Table 1.
Whole-rock analyses of Pahvant Butte basalt by electron microprobe (from Hoover, 1974).

Sample	P-Cl	P-34	P-38	P-13	P-06	P-Fc	P-01
SiO_2	50.30	48.82	48.03	50.63	49.78	50.39	50.67
TiO_2	1.46	1.46	1.44	1.49	1.48	1.43	1.53
Al_2O_3	18.33	17.05	16.81	17.96	17.32	17.28	17.08
Fe_2O_3, FeO	7.77	8.38	9.36	8.88	8.73	8.59	8.87
MnO*	0.13	0.13	0.15	0.11	0.13	0.14	0.13
MgO	6.70	7.86	8.38	5.41	6.76	7.07	6.68
CaO	10.29	11.56	11.80	10.89	10.44	10.59	10.78
Na_2O	3.38	2.96	2.78	3.16	3.18	3.09	3.07
K_2O	1.05	0.95	0.67	1.17	1.07	1.05	1.10
P_2O_5	0.29	0.31	0.32	0.33	0.37	0.28	0.33
Total	99.70	99.48	99.74	100.03	99.26	99.91	100.24

*All MnO values were determined by X-ray fluorescence

Table 2.
K-Ar ages on Pahvant Ridge basalt.

Age (yrs. B.P.)			Reference
220,000	±	260,000	Condie and Barsky, 1972
31,000	±	38,000	Hoover, 1974
32,000	±	51,000	Hoover, 1974
70,000	±	56,000	Hoover, 1974
93,000	±	78,000	Hoover, 1974
133,000	±	97,000	Hoover, 1974
180,000	±	180,000	Best, and others, 1980
160,000	±	160,000	Best, and others, 1980

Table 3.
Microprobe analyses of glass from Pahvant Butte basaltic ash (from Oviatt and Nash, 1989).

Sample	PBN-2(A)	PBN-2(B)	K-5A	B-1A	80-15	M-6	ORB	MP	L-2	L-6
SiO_2	50.8	50.9	50.8	50.5	51.1	50.3	50.8	51.2	51.0	51.4
TiO_2	1.78	1.81	1.81	1.60	1.66	1.76	1.61	1.65	1.73	1.65
Al_2O_3	16.1	16.0	16.2	16.1	15.8	15.5	15.7	15.5	15.7	15.5
Fe_2O_3, FeO	11.4	11.2	11.6	11.6	11.8	11.4	12.1	12.3	12.1	12.9
MnO	0.18	0.17	0.18	0.19	0.18	0.17	0.20	0.19	0.19	0.22
MgO	5.49	5.62	5.28	5.09	5.31	5.31	4.89	4.95	4.96	4.40
CaO	9.17	9.11	8.88	8.64	8.91	8.84	8.57	8.51	8.48	8.20
Na_2O	3.20	3.24	3.31	3.33	3.36	3.30	3.34	3.37	3.30	3.35
K_2O	1.27	1.22	1.27	1.27	1.29	1.28	1.34	1.33	1.33	1.49
P_2O_5	0.44	0.48	0.43	0.37	0.34	0.38	0.35	0.32	0.34	0.38
Cl*	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.03
F*	0.06	0.06	0.05	0.07	0.05	0.07	0.05	0.07	0.08	0.07
Total	99.9	99.8	99.8	98.8	99.8	98.3	99.0	99.4	99.2	99.6

*Detection limits for Cl and F are 0.01 and 0.04 percent, respectively.

quadrangle, the white marl was deposited both above and below the Provo shoreline of Lake Bonneville. The best preserved and most complete exposures of the marl are in a deep ditch (not mappable) in the NE¼NE¼ section 34, T. 18 S., R. 5 W. (figure 6) where the following section of strata was measured.

Ground surface elevation 4,795 feet (1,462 m)

	feet	meters
Tan, calcareous, sandy, pebbly silt (Qla)	1.62	0.49
White, indistinctly laminated marl	0.60	0.18
Black and dark-gray, laminated Pahvant Butte ash	0.48	0.15
White, indistinctly laminated marl	3.13	0.95
Tan, silty gravel with abundant spired gastropods	0.38	0.12
Tan, calcareous silt (to bottom of ditch)	1.24	0.38

The largest exposure of Qlm is in a Utah Department of Transportation borrow pit in the SE¼NE¼ section 22, T. 19 S., R. 5 W. where 2.5 to 3.0 feet (0.8 to 0.9 m) were excavated for highway construction. Qlm overlies the Pahvant Ridge basalt in several places.

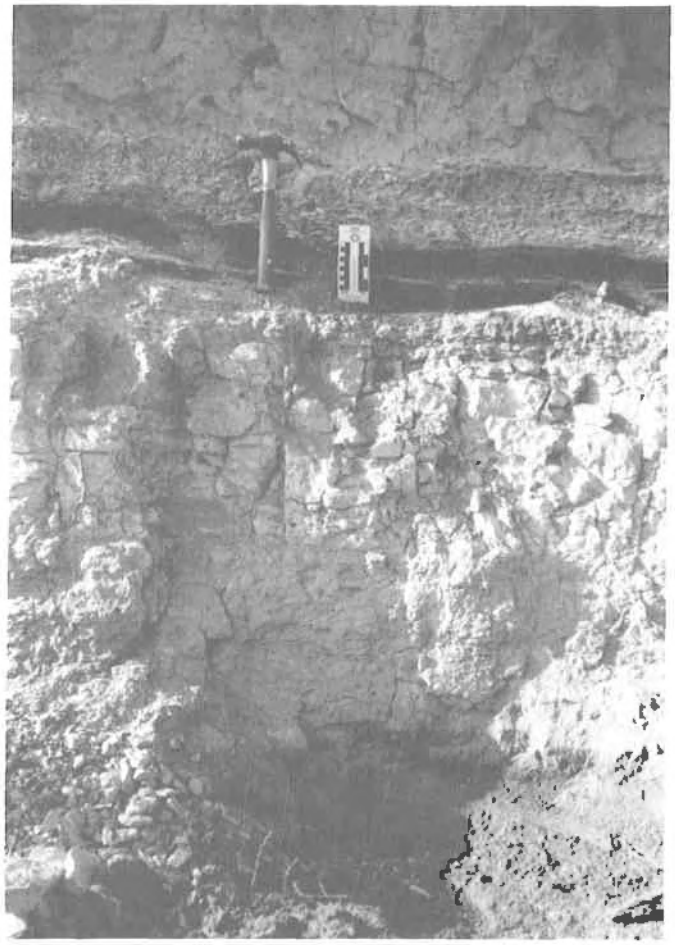


Figure 6. Exposure of white marl that was deposited offshore in Lake Bonneville. The Pahvant Butte ash, 0.48 feet thick, is interbedded near the top of the marl. Hammer for scale.

Lacustrine sand (Qls)

Tan, pebbly, fine- to coarse-grained sand forms the Provo shoreline beach ridge in the southeast part of the map area. The sand is loosely cemented by calcium carbonate, at least sufficiently to inhibit its erosion by wind. The beach ridge is 2 to 4 feet (0.6 to 1.2 m) high and the surface of the beach is at an elevation of about 4,770 feet (1,454 m). In the east-central part of the quadrangle, the Provo shoreline is obscured by windblown sand. In the northeastern part of the map area, the shoreline has carved a notch in the alluvial piedmont of the Canyon Mountains. At the north edge of the map, the shoreline is fairly close to an elevation of 4,785 feet (1,458 m). Therefore, it has isostatically rebounded about 15 feet (4.6 m) more than the shoreline 6.7 miles (11 km) to the southeast.

Lacustrine and alluvial deposits undifferentiated (Qla)

The surficial deposits of the pre-Lake Bonneville alluvial fans that form the piedmont on the east side of the quadrangle were reworked by waves and currents in Lake Bonneville. The lacustrine sediment component is usually thin and not everywhere present. Post-lacustrine alluviation and sheetwash has reworked the lacustrine sediments in some places. The reworked and intermixed deposits are indistinguishable. Qla ranges from a tan sandy silt to a tan silty and gravelly fine sand. Locally, the deposit contains a high percentage of gravel. On air photos, Qla is expressed geomorphically as alluvial fans or piedmont slopes etched by discontinuous shorelines. Exposures range from 1 to 4 feet (0.3 to 1.2 m) in thickness. Qla is late Pleistocene and Holocene in age.

Holocene Deposits

Marsh deposits associated with springs (Qsm)

This map unit consists of gray to black organic mud in marshy areas. Eight of these small deposits are shown on the map and at least two of the springs are probably related to a fault. In the south-central part of the quadrangle, three artesian water wells have produced muddy, marshy areas (figure 7). The thickness of Qsm deposits is probably only 2 to 5 feet (0.6 to 1.5 m).

Playa mud (Qpm)

Six ground-water discharging playas are mapped in the southwest part of the quadrangle, and in the northwest corner of the quadrangle a series of large and small discharging playas are connected by shallow waterways and partially separated by lunettes. The upper part of the playa deposits typically consists of laminated, very calcareous, light-gray silt with a large gypsum content. Some laminations of clay and very fine sand are usually present as well. All playas in the quadrangle are believed to be "blowouts," shallow basinal areas of deflation where the ground

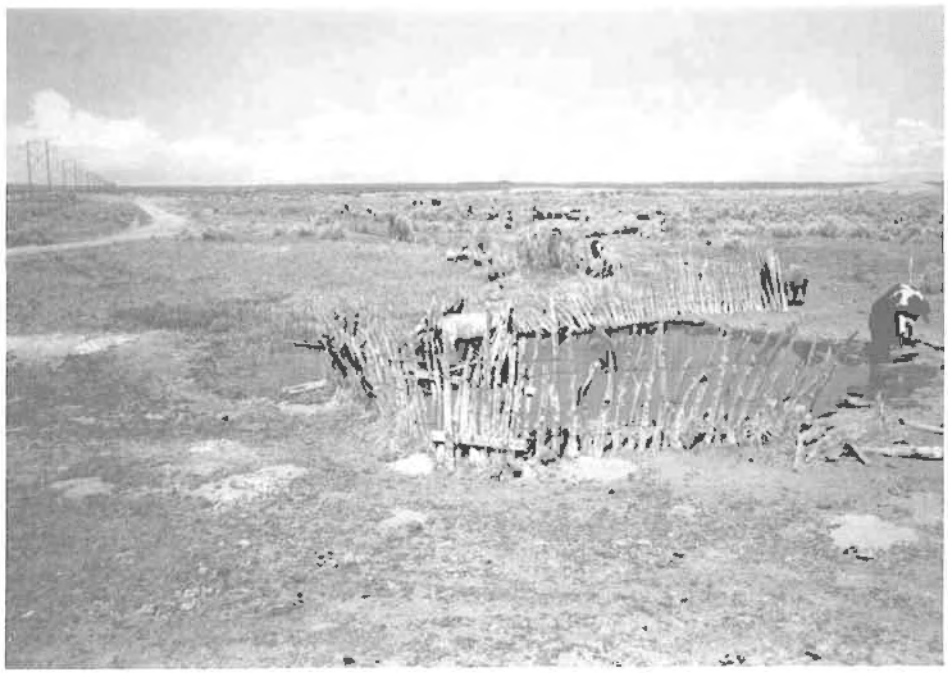


Figure 7. *An artesian water well in the NW¼NW¼ section 21, T. 19 S., R. 5 W. supplies a stock pond and a marshy area.*

surface has been lowered to the level of the shallow, seasonally fluctuating, unconfined water table. In many places the playas have a thin, white or tannish-white alkali crust. There are no vertical exposures, but the alkali playa mud is probably at least 5 to 10 feet (1.5 to 3.0 m) thick.

Eolian mud (Qem)

Eolian mud forms barchan dunes and irregularly shaped lunettes 4 to 10 feet (1.2 to 3.0 m) high in the playa area in the northwestern part of the quadrangle. The mud consists of light-gray, non-stratified, calcareous, windblown dust from adjacent playas with abundant minute white and clear gypsum and calcite concretions. Some of the lunettes have flat, broad crests, and others have rounded, narrow crests.

Eolian dunes (Qed)

Morphologically well-developed, active sand dune fields are found in the southern half of the map area. Dome dunes, barchanoid ridges, barchan dunes, and transverse dunes are common where the sand supply is abundant (figure 8). The dunes consist of tan, silty, fine sand that is well sorted, and about 80 percent clear to white, frosted quartz grains. The remaining 20 percent consists of feldspar, pyroxene, and magnetite grains as well as red and green quartz. The dunes range up to 32 feet (10 m) high and, in general, do not migrate very rapidly even though they are not stabilized by vegetation. A local farmer informed me that in 1960 a fence line was built along the north base of a large dune in the NW¼SE¼ section 26, T. 19 S., R. 5 W. In the summer of 1990, that same dune had covered a fence post and the base of the dune was 5 feet (1.5 m) beyond the fence. This may, or may not, be typical of local dune mobility. The prevailing wind direction is to the northeast.

Eolian sand (Qes)

These deposits consist of eolian sand in sheets, irregular mounds, shrub-coppice dunes, and longitudinal ridges (trending northeast) that are mostly stabilized by vegetation. These landforms are 1 to 8 feet (0.3 to 2.4 m) high, and the sand size and composition is the same as that for Qed. The average gradation of two samples of Qes was 15.7 percent coarse sand, 78.2 percent fine sand, and 6.1 percent silt. The black volcanic ash content of the sand increases westward in the quadrangle and adjacent to the Pahvant Ridge basalt the Qes is largely black, sand-sized ash. On aerial photographs, the black ash mounds are impossible to distinguish from nearby basalt outcrops.

Alluvial-fan deposits (Qaf)

Alluvial-fan deposits consist of poorly sorted, coarse- to fine-grained alluvium of Whisky Creek and an unnamed stream channel north of Whisky Creek in the northeast part of the quadrangle. There are no perennial streams in the quadrangle, and the alluvium is chiefly flood deposits of silt, fine sand, and clasts of quartzite and limestone. The unnamed creek has deposited a small alluvial fan at the Provo shoreline in the NW¼ section 27, T. 18 S., R. 5 W. The Qaf deposits are about 1 to 5 feet (0.3 to 1.5 m) thick. In the banks of Eightmile Creek in section 14, T. 19 S., R. 5 W., there are lenses of silty gravel that are 1 to 4 feet (0.3 to 1.2 m) thick. However, these gravel deposits are not shown separately on the map.



Figure 8. A view south of active sand dunes in SE¼SE¼ section 8, T. 19 S., R. 5 W. The strongly prevailing wind direction is to the northeast.

STRUCTURAL GEOLOGY

The McCornick quadrangle is on the east side of the large, structural Sevier Desert basin in the eastern part of the Basin and Range Physiographic Province. Except for the nondescript Oak City Formation, all surficial deposits in the quadrangle are Quaternary in age. Bedding attitudes of these thin deposits are horizontal or nearly so. Information on the attitudes of subsurface rocks is meager.

Sevier Desert Detachment Fault

McDonald (1976, p. 304), with petroleum industry seismic-reflection data, described a prominent reflector dipping gently westward beneath the Sevier Desert basin. He interpreted the reflector as a detachment surface, at depth, along which major eastward thrusting occurred during compression (Sevier orogeny), and later, westward movement during extension (basin-range block faulting). He also noted that high-angle extensional faults did not cut the detachment surface but soled into it. Allmendinger and others (1983) reported on data collected by the Consortium for Continental Reflection Profiling (COCORP). This continental-scale, west to east, deep seismic-reflection survey crossed Millard County including the Sevier Desert (figure 9). They found that the Sevier Desert basin is underlain by a major, west-dipping detachment fault that averages about a 12 degree dip from the surface at the west side of the Canyon Mountains to a depth of 7.5 to 9.3 miles (12-15 km) on the east side of the House Range, a distance of 45 miles (72 km). The data also verified on a more regional scale McDonald's (1976) observation that normal faults displacing middle and upper Cenozoic strata of the Sevier Desert basin do not cut the detachment surface.

Furthermore, several normal faults offset a strong seismic reflection from a 4.2 ± 0.3 million-year-old basalt. Therefore, the Sevier Desert detachment must have undergone extensional movement in a down-to-the-west sense at least as recently as the Pliocene. Von Tish and others (1985) determined that extension along (and above) the detachment occurred in at least two stages. (1) Westward movements of 12 to 18 miles (20-30 km) that began after the middle Oligocene (26-28 million years ago) and continued into the Miocene. These movements were followed by a probable short interval of stillness and erosion. (2) Westward movements of less than 5 miles (8 km) which began during or after eruption of the middle Pliocene (4.2 million years old) basalt are still ongoing as indicated by fault scarps that displace Quaternary deposits in the basin.

Mitchell and McDonald (1987, p. 539), using seismic reflection data and control from seven wells, made an isopach map of Tertiary strata in the Sevier Desert basin. The deep parts of the basin contain over 11,000 feet (3,300 m) of Tertiary fluvial, lacustrine, and volcanic rocks.

Placid Oil Henley No. 1 Well

Cross section A-A′ (plate 2) was drawn across the northern part of the quadrangle so that the distance, 1.3 miles (2 km), of projection of data from the Placid Oil Henley No. 1 well would be minimized. This well was drilled in 1980-1981 in the NW

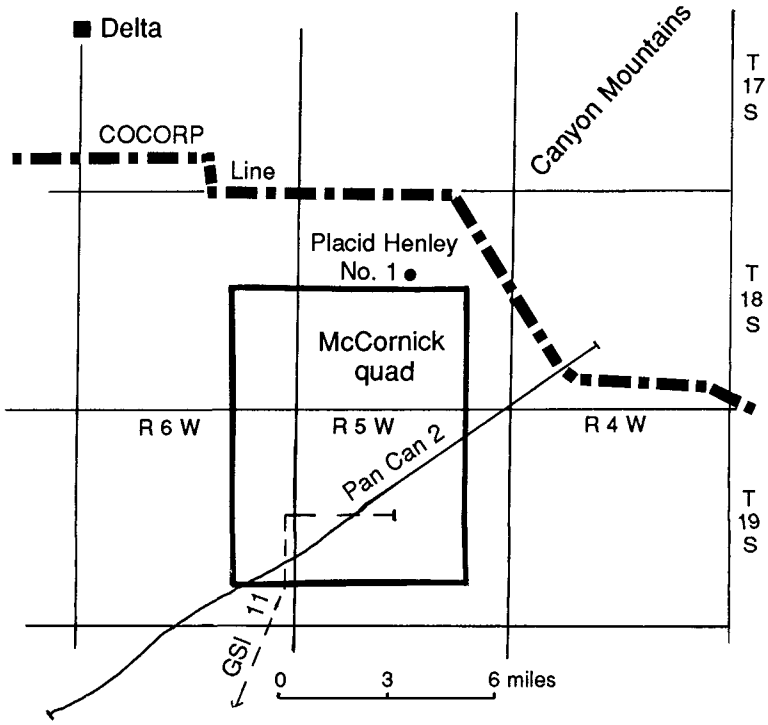


Figure 9. *Map showing the location of the Placid Henley No. 1 well, the COCORP line, Pan Can seismic line 2, and G.S.I. seismic line 11.*

¼NW¼ section 15, T. 18 S., R. 5 W., about ½ mile (0.8 km) north of the quadrangle (figure 9). Total depth was 13,106 feet (3,995 m). Lithologic information from the well log was projected to the line of cross section at the same elevation. Dips of Late Cretaceous and Tertiary strata were 18 degrees northwest and dips of Paleozoic strata were 30 degrees southwest.

The Flagstaff Formation (lower Eocene) was encountered at a depth of 150 feet (46 m), but it was only 11 feet (3.4 m) thick, and may be an eroded remnant. The North Horn Formation (Upper Cretaceous-lower Paleocene) was encountered at 161 feet (49 m) and continued to a depth of 1,760 feet (536 m) where an unconformity (detachment fault?) is present on the Ordovician Fish Haven Dolomite. Underneath the Fish Haven, at a depth of 1,950 feet (594 m), the Ordovician Eureka Quartzite was penetrated. At a depth of 2,010 feet (613 m), rocks of the Ordovician Pogonip Group were entered. Undifferentiated Cambrian carbonate rocks were drilled from 3,500 feet (1,067 m) to about 7,500 feet (2,286 m) where a thrust fault was cut. In the lower thrust plate, the Ordovician Eureka Quartzite to Cambrian carbonates section was repeated. The well reached total depth in the Cambrian Pioche Formation.

The strata beneath the unconformity (detachment fault?) at a depth of 1,760 feet (536 m) are indigenous to the Pahvant thrust plate (Hintze, 1988, p. 167). The depth of 1,760 feet (536 m) is at approximately the right level for the postulated Sevier Desert detachment as interpreted by Allmendinger and others (1983) and Mitchell and McDonald (1987). The Paleozoic rocks, the unconformity (detachment fault?), and the North Horn and Flagstaff Formations were tilted westward by uplift of the Canyon Mountains in post-middle Oligocene time (Campbell, 1979, p.8). The thrust fault at a depth of about 7,500 feet (2,286 m) is apparently a thrust within the Pahvant plate.

McCornick Fault

The only mappable structural feature in the quadrangle is a down-to-the-west normal fault that can be traced from the northwest part of the quadrangle to the south-central part of the quadrangle. The fault borders the east side of the Sevier Desert basin and is herein named the McCornick fault. The original inclination of the fault surface cannot be ascertained in the field, but the fault is probably a high-angle extensional feature. Along the northern part of the fault, the west side has dropped down, revealing QTln in the footwall. Along the southern part of the fault, displacement is even greater and the Oak City Formation is exposed in the footwall.

Parts of two seismic reflection lines crossed the southern part of the McCornick quadrangle (figure 9). Pan Canadian (Pan Can) seismic line 2 (McDonald, 1976) crosses the quadrangle from the southwest corner through the middle of the east border. Geophysical Services, Inc. (G.S.I.) seismic line 11 (Mitchell and McDonald, 1987) enters the southwest part of the quadrangle, goes north for two miles (3.2 km), then east for three miles (4.8 km), and ends at the junction of Utah Highway 100 and U.S. Highway 50.

The McCornick fault is recognizable on both seismic lines. Pan Can 2 crosses the fault at an oblique angle while G.S.I. line 11 crosses the fault almost at a right angle. On Pan Can line 2, the fault is shown as a high-angle extensional fault that bounds the east side of a southeast-northwest-trending graben. Reflectors show that sediments dip steeply on both sides of the graben. Identical reflectors could not be traced across the McCornick fault to determine its offset. The postulated west-bounding fault of the graben is either just west of the McCornick quadrangle or is not expressed topographically or geologically on the west side of the quadrangle.

On G.S.I. line 11, the McCornick fault appears as a more gently sloping normal fault on the east side of a southeast-northwest-trending sediment-filled trough. No fault is visible on the west side of the trough. Reflectors are offset 1,500 to 1,800 feet (450-550 m) by the McCornick fault. The fault soles listrically westward into the interpreted Sevier Desert detachment at a depth of about 6,000 feet (1,830 m). Presumably, most of the trough is filled with Miocene, Pliocene, and Pleistocene fluvial and lacustrine sediments and volcanic rocks. Some reflectors inside the trough dip downward toward the base of the trough and quite likely represent thick fluvial deposits. I suspect that the McCornick fault has moved repetitively since late Oligocene time. Each movement activated a wedge of fluvial deposition into the trough. Pleistocene movement has offset QTln beds.

ECONOMIC GEOLOGY

Ground water and sand and gravel are the chief geologic resources utilized in the McCornick quadrangle. Small labradorite crystals have been found in and around the basalt on the west side of the quadrangle, but they are scarce and not of gemstone quality.

Ground Water

By the end of 1987, at least 26 water wells had been drilled in the McCornick quadrangle (Thiros, 1988, plate 1). Four of the wells in the south-central part of the quadrangle are artesian and provide livestock water. All other producing wells are in the eastern part of the quadrangle and have to be pumped. Information is available for 20 wells that range in depth from 186 to 667 feet (57 to 203 m) and average 418 feet (127 m) deep (Thiros, 1988, p. 4 and 6). Correlation of units between driller's logs was not possible due to the lenticular and interfingering nature of the subsurface strata. However, there appear to be two or three aquifers, at slightly different depths and perhaps overlapping, that are interconnected by leakage. Static water levels in the pumped wells range from 2 to 94 feet (0.6 to 29 m) deep. The pumped wells yield from 500 to 2,500 gallons per minute (1,900 to 9,500 L/min), and the artesian wells flow from 13 to 101 gallons per minute (49 to 384 L/min) (Thiros, 1988, p. 4 and 6). The water from the wells is used for irrigation and watering livestock. Chemical analyses of the ground water are available for five wells in the quadrangle. Water hardness ranges from 540 to 2,100 mg/L (Thiros, 1988, p. 133).

Five springs are in the quadrangle; three in the central part and two in the northwest part. All support marshy areas that are especially wet during spring months. Two of the springs in the central part of the quadrangle are associated with the McCornick fault. The shallow ground-water table is just 2 to 3 feet (0.6 to 0.9 m) below the ground surface in the western part of the quadrangle and during the springtime it is at the surface of the playas.

Sand and Gravel

Over the years, sand and gravel have been excavated from two pits in the SW¼ section 10, T. 19 S., R. 5 W. for the construction and reconstructions of U.S. Highway 50. The two pits are Utah State Highway Department designated material site 14065 (Utah State Highway Department, 1966).

The two pits are in a lacustrine gravel deposit (Qlg). The gravel is mostly hard quartzite and limestone and has been used for highway pavement and base course aggregate. In 1960, the U.S.H.D. sampled the deposit from an 18-foot (5.5 m) test hole (U.S.H.D., 1966). The sample was 55 percent gravel, 38 percent sand, and 7 percent silt and clay which is a good construction mixture. Insofar as tested, the material met specifications for highway construction; it was non-plastic and had a low swell of 0.007 percent. A large reserve is present. The easternmost pit in the deposit can be deepened and extended at least 300 feet (90 m) eastward.

GEOLOGIC HAZARDS

Earthquakes, locally poor soils, and windblown sand are the main geologic hazards in the quadrangle.

Earthquakes

The McCornick fault is the only Quaternary extensional fault mapped near the east margin of the Sevier Desert basin. The displacement per event and the faulting recurrence interval are presently unknown. Von Tish and others (1985, p. 1086) showed that the rate of Cenozoic extension in the Sevier Desert basin has probably ranged between 0.016 to 0.075 inch/year (0.4-1.9 mm/year). Renewed movement on the McCornick fault will take place sooner or later. The quadrangle is located in Uniform Building Code Seismic Zone 3 in Utah (International Conference of Building Officials, 1991). Zone 3 has the highest potential for earthquakes in the state.

Poor Soils

The playas in the western part of the quadrangle contain a high percentage of silt, clay, and soluble salts. In addition, there is a high ground-water table. The playas are unsuitable for any type of structure, even a road. Some areas of fine-grained lacustrine deposits (Qlf), especially adjacent to the playas, would have essentially the same problems. Soil and foundation testing should be done for structures contemplated in these areas.

Windblown Sand

Much windblown sand is present in the quadrangle (Qes and Qed). During unusually strong winds, the sand can produce poor driving visibility and can migrate over roads, fences, and fields.

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