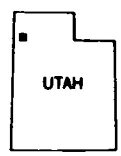
GEOLOGIC MAP OF THE JACKSON QUADRANGLE, BOX ELDER COUNTY, UTAH

By David M. Miller and Linda L. Glick
U.S. Geological Survey



UTAH GEOLOGICAL AND MINERAL SURVEY
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MAP 95 **1987**

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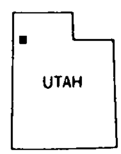

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UTAH GEOLOGICAL AND MINERAL SURVEY

606 Black Hawk Way
Salt Lake City, Utah 84108-1280

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GEOLOGIC MAP OF THE JACKSON QUADRANGLE, BOX ELDER COUNTY, UTAH

By David M. Miller[1] *and Linda L. Glick*[2]
U.S. Geological Survey

INTRODUCTION

THE Jackson quadrangle in northwestern Utah (figure 1) comprises lowland of the Great Salt Lake Desert, the eastern part of Pigeon Mountain, and part of the Little Pigeon Mountains. Pigeon Mountain, at an elevation of 1555 m (5100 feet), is the highest point in the quadrangle. The lowland comprising about 95 percent of the quadrangle ranges in elevation from 1320 m (4330 feet) to 1288 m (4225 feet), with most of the area under 1298 m (4260 feet).

Mountainous parts of the Jackson quadrangle are underlain by Devonian and Permian sedimentary rocks of the Cordilleran miogeocline. These strata, which accumulated under shallow-marine conditions on the ancient continental shelf, are similar in most respects to those at Lemay Island (figure 1). The remainder of the quadrangle is covered by surficial deposits of Quaternary age, including alluvium, lake sediments, and eolian sand. Much of the Quaternary sediment was deposited in Pleistocene Lake Bonneville, which covered the entire quadrangle at its high stand. The major structural features and physiography of the quadrangle—mountain ranges composed of pre-Cenozoic rocks and broad valleys filled with thick sequences of Cenozoic strata—resulted from one or more episodes of upper crustal extension in Neogene time.

Previous geologic study in the quadrangle was small-scale mapping by Doelling (1980). Companion reports (Glick and Miller, 1986; 1987; Miller and Glick, 1986) describe the Pigeon Mountain, Lemay Island, and Lucin 4 NW quadrangles (figure 1).

DESCRIPTION OF UNITS

DEVONIAN ROCKS

Simonson Dolomite

The upper part of the Simonson Dolomite (Ds) is exposed in small hills at the east end of the Little Pigeon Mountains. The Simonson is predominantly black, medium-bedded dolomite. Diagnostic features include interbedded light-gray dolomite and finely laminated dark dolomite beds. The dolomite is highly fractured.

Guilmette Formation

Concordantly overlying the Simonson Dolomite in the Little Pigeon Mountains is the lower part of the Devonian Guilmette Formation (Dg). The unit is characterized by fractured, light-gray-weathering, dark-gray limestone, and subordinate dark-gray to black dolomite. It is massive to thick bedded.

PERMIAN ROCKS

Grandeur Formation of the Park City Group

The Grandeur Formation (Ppg) is a resistant, cherty unit of sandy dolomite and sandstone that conformably underlies the Meade Peak Phosphatic Shale Tongue of the Phosphoria Formation (exposed in the Pigeon Mountain quadrangle; Glick and Miller, 1987) in the Little Pigeon Mountains. The Grandeur Formation comprises a lower part of resistant cherty sandstone and an upper part of predominantly sandy dolomite. The unit is approximately equivalent to the chert and dolomite unit in the northern Pilot Range (Miller, 1985), although that unit may locally include rocks older than the Grandeur.

Murdock Mountain Formation

The predominant rock type in the Permian Murdock Mountain Formation (Pm) in Pigeon Mountain is black to charcoal-gray, thin-bedded chert that shows ubiquitous development of rosy pink to red coloration on exposed surfaces. Black and brown sandstone and siltstone, medium-gray dolomite and dolomitic sandstone, and rare limestone constitute about 20 percent of the formation. In the Little Pigeon Mountains, exposures of the basal part of the Murdock Mountain Formation contain thin-bedded black chert and minor dolomitic sandstone.

Doelling (1980) referred the cherty sequence of rocks in Pigeon Mountain to the Rex Chert, but assignment to the Murdock Mountain Formation is followed herein for consis-

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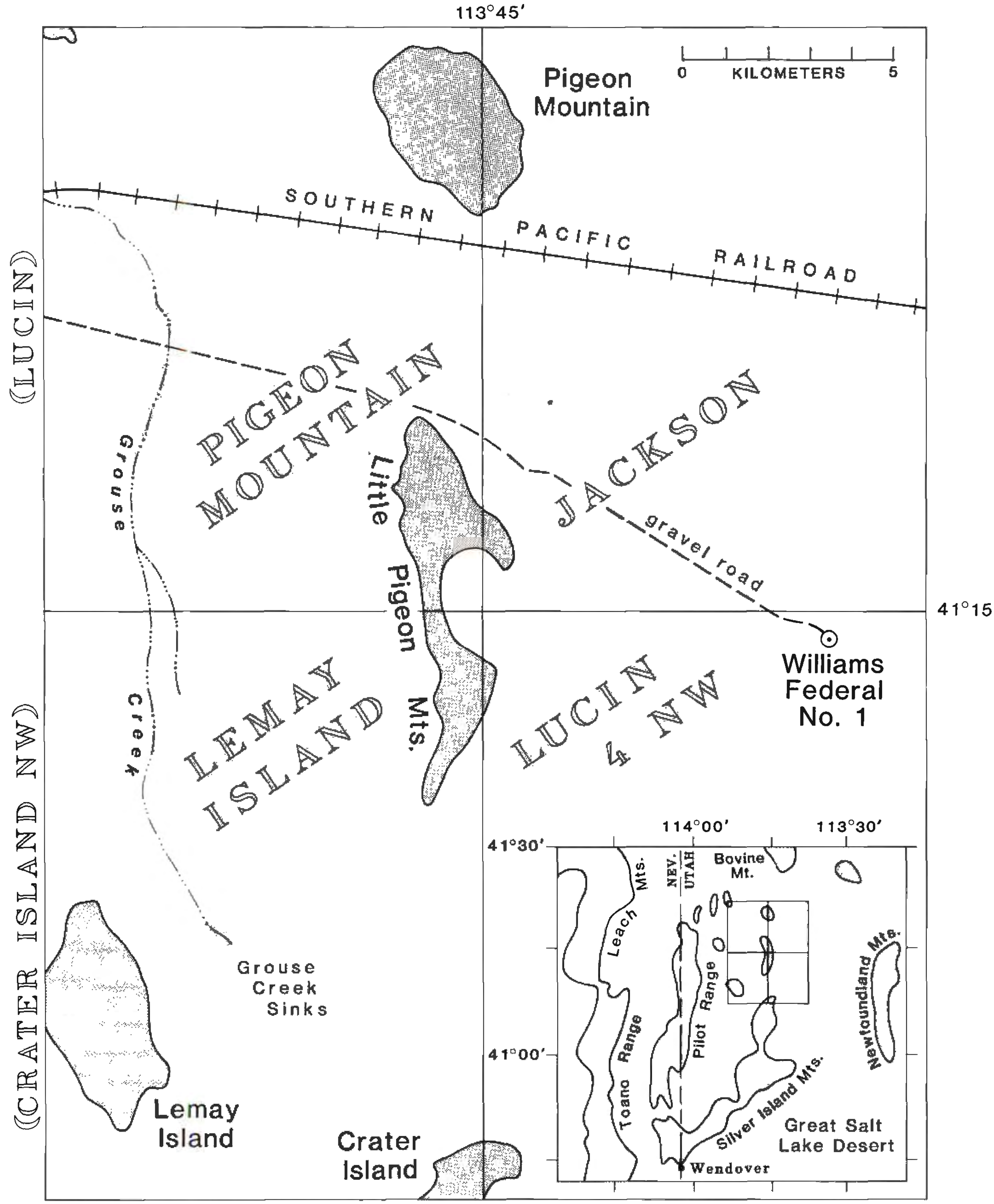

Figure 1. Location map showing mountains (shaded areas) and cultural features in the Lemay Island, Pigeon Mountain, Jackson, and Lucin 4 NW quadrangles, and location of these quadrangles in northwest Utah.

tency with the neighboring Lemay Island quadrangle (Miller and Glick, 1986) and other assignments in the region. In the Leach Mountains, Miller and others (1984) showed the Murdock Mountain Formation to be latest Leonardian and early Guadalupian in age. An early Guadalupian age was supported by fossils collected in the formation at Pigeon Mountain at locations in the adjoining Pigeon Mountain quadrangle (Glick and Miller, 1987).

TRIASSIC ROCKS

Unnamed Triassic sandstone (₸u) is poorly exposed in the Jackson quadrangle near the crest of Pigeon Mountain. The slope-forming unit of calcareous sandstone occurs as a fault block between two sections of the Murdock Mountain Formation, where it is composed mainly of tan to yellow, platy to thin-bedded, calcareous sandstone and siliceous siltstone. Conodonts, collected from limestone beds in this unit that are exposed in the adjacent Pigeon Mountain quadrangle, are Early Triassic (Glick and Miller, 1987). The Triassic age, along with some lithologic similarities, suggests that the calcareous sandstone in Pigeon Mountain may represent the Thaynes Limestone. The unit lacks shale and ammonoid-bearing strata that are typical of the Triassic Dinwoody Formation.

QUATERNARY DEPOSITS

Two roads east of Pigeon Mountain and the Little Pigeon Mountains provide the only easy access to Quaternary deposits. Studies near the roads and along several traverses away from roads, along with aerial photograph interpretation, form the basis for our understanding of the Quaternary deposits.

An abrupt boundary between alluvial silt and alluvial mud deposits coincides with the Gilbert Shoreline of Lake Bonneville. The elevation of this boundary (1300 m; 4265 feet) nearly matches previously reported elevations for the Gilbert Shoreline in the Jackson quadrangle and nearby areas (Currey, 1982). The Gilbert Shoreline is commonly marked by sand and gravel concentrated in pavement on gently west-dipping ancient beach surfaces. West of the shoreline, vegetated, hummocky silt and fine-grained sand dunes are widespread; some sand dunes appear to be truncated at the shoreline. Alluvium in this area above the Gilbert Shoreline is pebbly, and probably represents reworked lacustrine sediments deposited during the regression from the Provo level. East of the shoreline are flat-lying mud and silt deposits that support only sparse short vegetation and black algae. This alluvium contains no pebbles and is interpreted as reworked lake deposits from the Gilbert stand.

In the southwest part of the quadrangle the distinctive Gilbert Shoreline disappears where alluvial silt deposits extend to elevations below 1298 m (4260 feet). This extension of alluvial silt may represent either ancient alluvium that was not effectively reworked by Gilbert shoreline processes, or alluvium that was deposited across the shoreline after the regression of the lake. The east trend of the silt deposits coincides with the trends of older alluvial gravel deposits (Qag). In addition, springs near the distal margin of the alluvial silt deposits (figure 2) may indicate that subsurface water still follows older channels.

Lacustrine gravel was deposited in beaches at about 1306 m (4285 feet) elevation on the east side of Pigeon Mountain and the Little Pigeon Mountains. These beach deposits represent striking accumulations of gravel, and at the Little Pigeon Mountains a lagoon was formed behind one beach. Gravel beaches at the same elevation were noted in the Lemay Island quadrangle (Miller and Glick, 1986) and in the Silver Island Mountains (figure 1; D. M. Miller, 1985, unpubl. mapping).

Mass movement deposits

Hummocky ground east of the summit of Pigeon Mountain is composed of blocky debris of chert, sandstone, and dolomite derived from the Murdock Mountain Formation. The slide (Qms) occurs beneath and is derived from outcrops of the part of the Murdock Mountain that overlies the Gerster Limestone tongue; the slide mass overlies and obscures Triassic rocks. Wave-cut notches in the surface of the slide indicate that it is older than the high stand of Lake Bonneville.

Lacustrine silt

Vegetated areas that contrast with surrounding unvegetated mud flats are underlain by brown, calcareous silt and sand (Qli). The silt and sand contain sparse ooids that locally form thin cemented beds. The silt, which is about 10 cm thick, is underlain by brown silty clay and is overlain by 1 to 4 cm of white to light-brown clay containing salts. Minor eolian material occurs at the bases of shrubs. The silt unit is coarser grained than the alluvium that occurs up topographic gradient, and thus is unlikely to be alluvial. Ooids in the unit suggest that it is lacustrine.

Lacustrine oolite

Lacustrine oolite (Qlo) is stratigraphically overlain by eolian oolitic sand, and locally by fine-grained marsh or spring deposits and alluvial gravel. This unit is exposed predominantly in stream channels that have cut into the broad mud flats below the Gilbert Shoreline. The lower brown part of the unit consists of spherical and rod-shaped calcareous ooids in thin beds that commonly show climbing-ripple cross stratification. About 15 percent of the lower part is composed of sand and silt that form a matrix to the ooids; volcanic glass shards, chert, quartz, sanidine, and hornblende are the primary sand constituents. Commonly capping the lower part is a section about 5 to 10 cm thick, but locally as much as 0.5 m thick, consisting of thin, well-indurated oolite plates and beds about 1 to 3 cm thick. In southern outcrops the plates characteristically contain predominantly spherical ooids with about 15 percent sand matrix composed of quartz crystals, rounded quartz sand, and chert. In places, particularly in the northern outcrops, cemented zones within the brown part of the unit form platy zones that resemble, but are less indurated than, the plates in the upper cemented platy part of the unit. The cemented plates are morphologically and lithologically similar to the hydrogenic shingle of the Great Salt Lake described by Eardley (1938).

Both rod-shaped and spherical ooids appear to have very fine nuclei on which they formed, for only silt remained after dissolving them, and they are totally white calcite in cross

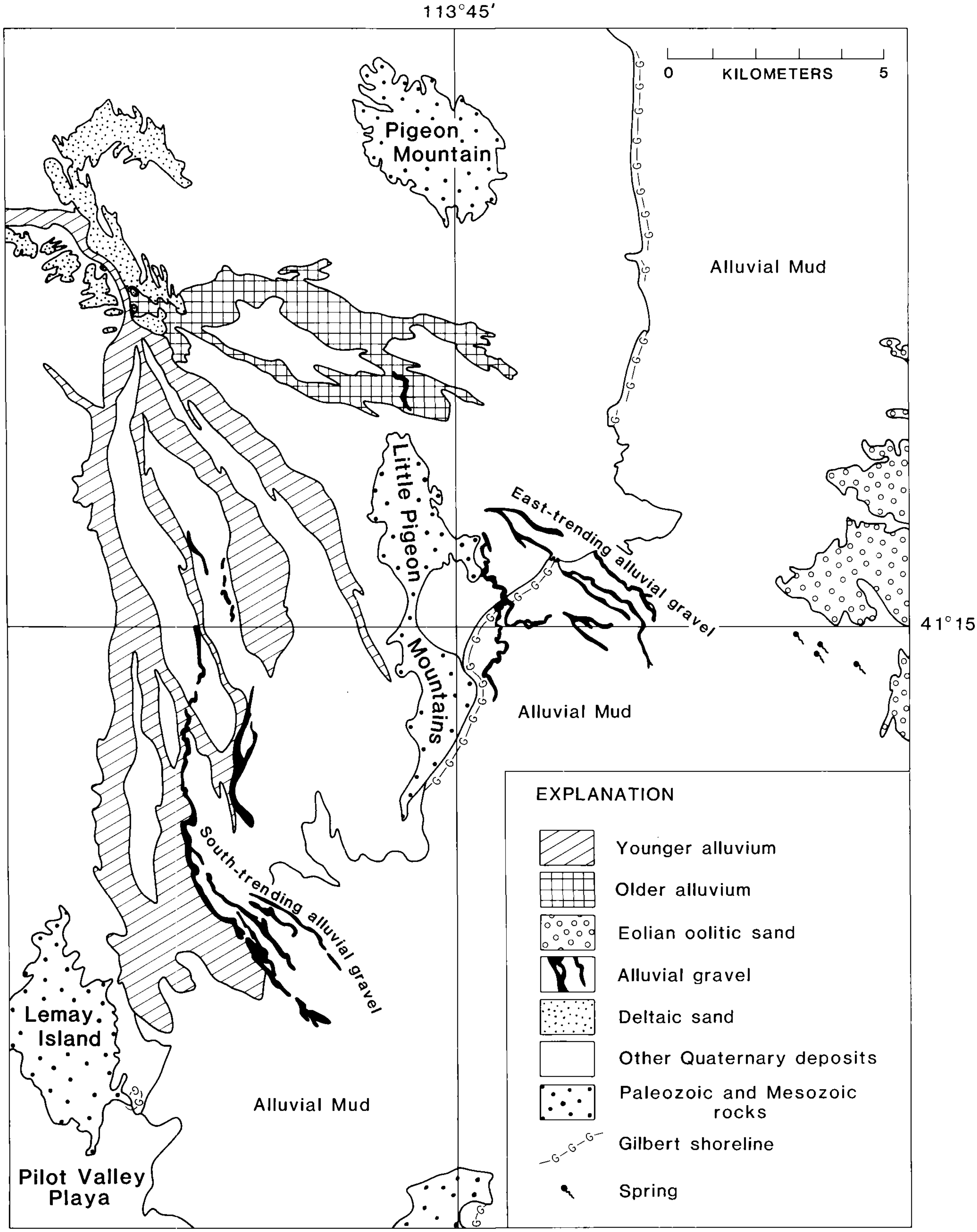

Figure 2. Map showing distribution of selected Quaternary deposits in the Lemay Island, Pigeon Mountain, Jackson, and Lucin 4 NW quadrangles. Area of map corresponds to figure 1.

section. Rod-shaped ooids in the Great Salt Lake were shown by Eardley (1938) to have formed around brine shrimp pellets. Such an origin for rod-shaped ooids in the lacustrine oolite is probable, on the basis of similar shape, but remains unproven. Ooids from the platy capping unit contain much more silt than those from the lower brown part.

Banks of lacustrine oolite are associated with alluvial silt deposits that may, in part, represent a deltaic projection into the lake. Crossbeds in the oolite indicate approximately shoreward currents. Thus, the ooids may have formed where abundant nuclei were being washed into the lake, or where a cuspate projection into the lake intensified wave action.

Nowhere do lacustrine deposits overlie the lacustrine oolite. The oolite is restricted to elevations below the Gilbert Shoreline, indicating that they may have formed during the Gilbert cycle or during some previous shallow lake stage. Because no alluvial sediments overlying the oolite show signs of reworking by the Gilbert lake, we postulate that the oolite was deposited during the Gilbert cycle.

Lacustrine gravel and sand

Deposits of gravel and sand (Qlg) formed at Lake Bonneville shorelines on the mountains and hills and as long spits and tombolos. Lacustrine gravel commonly overlies fine-grained lacustrine deposits such as diatomaceous marl at altitudes below the Provo Shoreline.

Alluvial gravel

Sinuous gravel ridges (Qag) grading laterally into and locally overlain by finer-grained alluvial deposits probably represent stream-channel deposits. These gravel ridges trend northeast to east and are continuous with gravel mapped in the Pigeon Mountain quadrangle north of the Little Pigeon Mountains as shown in figure 2. The gravel is bedded in lenses having long axes parallel to the ridges. Imbrication and cross-bedding indicate transport to the south and east.

The coarseness of the alluvial gravel deposits contrasts strongly with adjacent silt deposits. The gravel probably represents deposition from the Grouse Creek drainage shortly after the withdrawal of Lake Bonneville, or during or after the Gilbert cycle, when conditions were different from the present warm and dry cycle. Erosion of fine-grained deposits by sheet-flow and by eolian deflation produced the topographic inversion of the gravel ridges.

Older alluvium

Older alluvium (Qal_2) that was deposited by the distal Grouse Creek fan reached the western Jackson quadrangle. The deposits overlie Bonneville lake sediments but are older than most of the surrounding finer grained materials that are presently deposited mainly by sheet floods. The older alluvium may also predate the rise of Lake Bonneville to the Gilbert Shoreline during early Holocene time.

Playa mud

Muds (Qpm) ponded behind ancient barrier bars occur in the Little Pigeon Mountains. These muds increase in grain size to silt and sand near the gravel bar margins, and in some cases contain soluble salts.

Alluvial mud

Alluvial mud deposits (Qam) in the Jackson quadrangle are informally divided into western and eastern parts on the basis of subtle differences that occur across a north-trending boundary. The western part contains mud that is relatively dark and coarse, contains rare evaporite minerals, and is moderately vegetated with small shrubs and occasional black algae. The eastern part contains lighter colored mud that supports less vegetation, contains more evaporite minerals, ooids, and pervasive patchy, thin salt crusts. Radially oriented cracks and ridges caused by dessication and salt expansion and thin platy chips of well-indurated calcite are also common in the eastern part.

Alluvial silt

Alluvial silt deposits (Qai) are predominantly silt with minor clay, variable amounts of sand, and rare evaporite minerals. The alluvial silt unit, which underlies much of the eolian sand deposits, probably represents reworked fine lacustrine sediments.

Eolian sand

Eolian sand (Qes) forms small (2-meter-high), dune-like features in the western part of the quadrangle. These sand and silt deposits include reworked lake sediments such as evaporite minerals, small shell fragments, and, rarely, whole gastropod shells. The dunes generally trend northerly, suggesting west winds during their formation. Dunes near the Gilbert Shoreline in the northern part of the quadrangle appear to be truncated by lacustrine gravel deposits at that shoreline.

Eolian oolitic sand

Eolian sand composed of more than 50 percent ooids (Qeo) crops out in the eastern part of the quadrangle. The sand is white to cream-colored and consists mainly of spherical and rod-shaped calcareous ooids, with lesser detrital evaporite minerals and rock fragments. In northern exposures of the unit lithic grains constitute as much as 50 percent. The ratio between spherical and rod-shaped ooids is about 2:1 in the south and increases northward.

The eolian oolitic sand occurs as sand sheets and dunes that generally trend north and reach a height of 11 meters. The dunes occur east of the major exposure of their source, the lacustrine oolite. Resistant, slightly cemented vertical pipes (and nodules) in the sand may have been caused by cementation at fresh- to salt-water interfaces

The eolian oolitic sand is gradational with the non-oolitic eolian sand unit (Qes). A variable, but small, percentage of ooids exists in the nearby eolian sand and alluvial mud units. Eolian sand deposits within one kilometer west of the eolian oolitic sand unit may contain ooids; further west the eolian deposits contain none.

Younger alluvium

Coarse younger alluvium (Qal_1) occurs in a wash in the northern part of the Jackson quadrangle. The alluvium is derived from Bovine Mountain to the north. In contrast, other parts of the quadrangle are much farther down gradient from significant mountain areas to the northwest, and receive no modern coarse-grained alluvial materials.

Alluvial-fan deposits

Alluvial-fan deposits (Qaf) along the northwestern part of the quadrangle represent fans extending from small canyons in Pigeon Mountain.

Lacustrine and alluvial deposits, undivided

These deposits (Qla) are located adjacent to mountains, and consist of pre-Bonneville alluvial fan materials that were etched in places by lake shorelines and in other places thinly covered by patches of lacustrine gravel and sand.

INTERPRETATION OF QUATERNARY HISTORY

Surficial deposits in the Jackson quadrangle probably were deposited throughout Quaternary time, but many deposits predating Lake Bonneville were reworked and covered when the lake occupied the entire quadrangle. Older alluvial-fan deposits at Pigeon Mountain and the Little Pigeon Mountains were etched by waves and now display numerous wave-cut notches. Thin deposits of marl, gravel, and sand covered parts of the alluvial fans.

During the late Pleistocene, Lake Bonneville drowned the fan systems flanking the mountains. Rocks and sediments exposed at temporary lake levels were extensively modified by wave abrasion platforms and by beaches, bars, spits, and tombolos. Thick sequences of diatomaceous marl and other fine-grained sediments probably accumulated offshore from the beaches and on the older low-gradient alluvial plain deposits, but surficial records of the deeper water deposits exist only in restricted canyons in the mountains. During the regression from the Provo Shoreline in the late Pleistocene (Currey and others, 1984) lag gravel and sand were probably deposited across the area.

Alluvial systems once again were established in the region following lake regression, as indicated by the extensive thick alluvial deposits in the fan emanating from Grouse Creek (figure 2), including sinuous channel gravel deposits. Abundant fine sand and silt on the desert lowlands were reworked by wind.

In latest Pleistocene time, the distal part of the alluvial plain or low-gradient fan whose source was Grouse Creek was once again flooded as Lake Bonneville rose to about 1300 m (4265 feet) elevation at the inferred Gilbert stage. Transgressive Gilbert deposits are inferred to have covered the pebbly silt from the previous regression and the lake reworked older deposits at the shoreline to form gravel beaches. At this time, Grouse Creek may have built small deltaic fingers into the lake east of the Little Pigeon Mountains. Ooids forming in the shallow brackish water built a thick bank. As the lake regressed for the final time it reworked the most recently deposited, dominantly spherical, ooids and cemented them, forming platy beachrock as the capping layer of the oolite.

Following the withdrawal of the Gilbert stage of Lake Bonneville, wind-blown ooids formed dunes just east of the lacustrine oolite bank. Alluvium continued to be deposited by the Grouse Creek drainage, and it extended east of the Gilbert Shoreline in one area where locally it was deposited on lacustrine oolite. Alluvial deposits over most of the area formerly occupied by the Gilbert lake were muds moved by sheetflow processes, resulting in only slight modification of the former lake bottom. Eolian processes responsible for sand and silt dunes and sheets either were much less active following the Gilbert regression or they failed to migrate east of the Gilbert Shoreline for other reasons; in any case, dunes are rare east of the Gilbert Shoreline except where ooid deposits provided a ready source. Small marshes localized by springs probably fed by Grouse Creek ground water dotted the southern part of the quadrangle.

STRUCTURAL GEOLOGY

Structures in the Jackson quadrangle predate Quaternary surficial deposits that comprise about 95 percent of the quadrangle. Because of the limited outcrops of pre-Quaternary rocks, structures observed in one area are difficult to relate to those at another, and also are difficult to relate to the structural history of areas outside the quadrangle.

Faults separating Devonian from Permian strata in the Little Pigeon Mountains are not well exposed, but the map pattern implies that the strata are juxtaposed by a north-striking, probably high-angle, fault. The throw on this fault is roughly 2700 m (8860 feet) with the west side down. The north-striking fault is displaced by smaller faults that strike northwest or north-northwest; they are possibly related to similarly oriented, small reverse faults exposed to the southwest in the Little Pigeon Mountains in the Lemay Island quadrangle (Miller and Glick, 1986).

Strata at Pigeon Mountain define a broad, north-trending anticline whose crest is near the geographic center of the mountain, just west of the quadrangle border, and a complementary syncline to the east (section A-A′). The strata are cut by low-angle faults that are approximately parallel to bedding and by moderate-angle normal faults striking north and west-northwest. The moderate-angle normal faults cut a covered low-angle fault that truncates part of the Permian section, placing Triassic strata on middle Murdock Mountain Formation. Based on the structural history of the nearby northern Pilot Range (Miller and Schneyer, 1985), the bedding-plane faults probably predate folding and moderate-angle faulting. Moderate-angle faults postdate folding.

STRUCTURAL CONFIGURATION OF THE BASIN

On the basis of sparse gravity data, Cook and others (1964) inferred that a graben underlies the northeast quarter of the quadrangle. The western half of the quadrangle is underlain by a bedrock ridge, parts of which are exposed as the Little Pigeon Mountains and Pigeon Mountain. They also interpreted a shallowly buried platform extending east from the Little Pigeon Mountains, but a drill hole on this platform penetrated at least 713 m (2340 feet) of deposits overlying basement. The structure of this area is thus uncertain.

ECONOMIC DEPOSITS

No mines, quarries, or prospect pits were observed in the Jackson quadrangle during mapping, nor were any described in a recent compilation of the economic geology of Box Elder County by Doelling (1980). Four possible sources for mineral resources occur in the quadrangle; the potential for each is unknown and has not been evaluated.

(1) Silicified sedimentary rocks in parts of northern Nevada host disseminated gold. Parts of the Murdock Mountain and Grandeur Formations show replacement of sandstone or carbonate rock by silica and therefore have potential for gold resources.

(2) Brines at shallow depth in playas in the eastern part of the quadrangle may contain resources such as potash and lithium, which occur in brines elsewhere in the Great Salt Lake Desert (Nolan, 1927; Lines, 1979).

(3) Gravel that accumulated in beaches and tombolos at Pigeon Mountain and in the Little Pigeon Mountains is a source of construction materials.

(4) Oolite dunes provide a source of size-sorted, relatively clean calcium carbonate that, although remote from major transportation routes, is unconsolidated and therefore easily mined.

GEOLOGIC HAZARDS

Flooding caused by locally heavy precipitation or sustained areal precipitation is a hazard in the Jackson quadrangle. The roughly 95 percent of the quadrangle forming poorly drained flatland is subject to short-duration floods during local heavy rainfall. The fine-grained, sparsely vegetated soils in the flatland are generally slippery and soft when wet. The low gradient in the Jackson quadrangle promotes the distribution of waters along meandering channels and by sheetflood processes, making it difficult to predict flood locations.

Partly vegetated and unstable eolian sands, which are more than a meter thick in about 25 percent of the quadrangle and are present as thinner deposits in much of the remainder of the quadrangle, are subject to migration, particularly when disturbed.

Faults bordering the Pilot Range about 24 km (14 miles) west of the Little Pigeon Mountains cut Quaternary deposits and may be as young as early Holocene (Miller and others, 1982; Miller and Schneyer, 1985). Although the frequency and magnitude of earthquakes along this fault system are unknown, there is potential for earthquakes affecting the Jackson quadrangle.

ACKNOWLEDGMENTS

We are indebted to Jack Oviatt for providing much helpful information on Quaternary deposits during field visits and discussions. We thank S. L. Garwin for assistance during field mapping. Thoughtful reviews by Paul Stone and Jack Oviatt greatly improved earlier versions of this manuscript.

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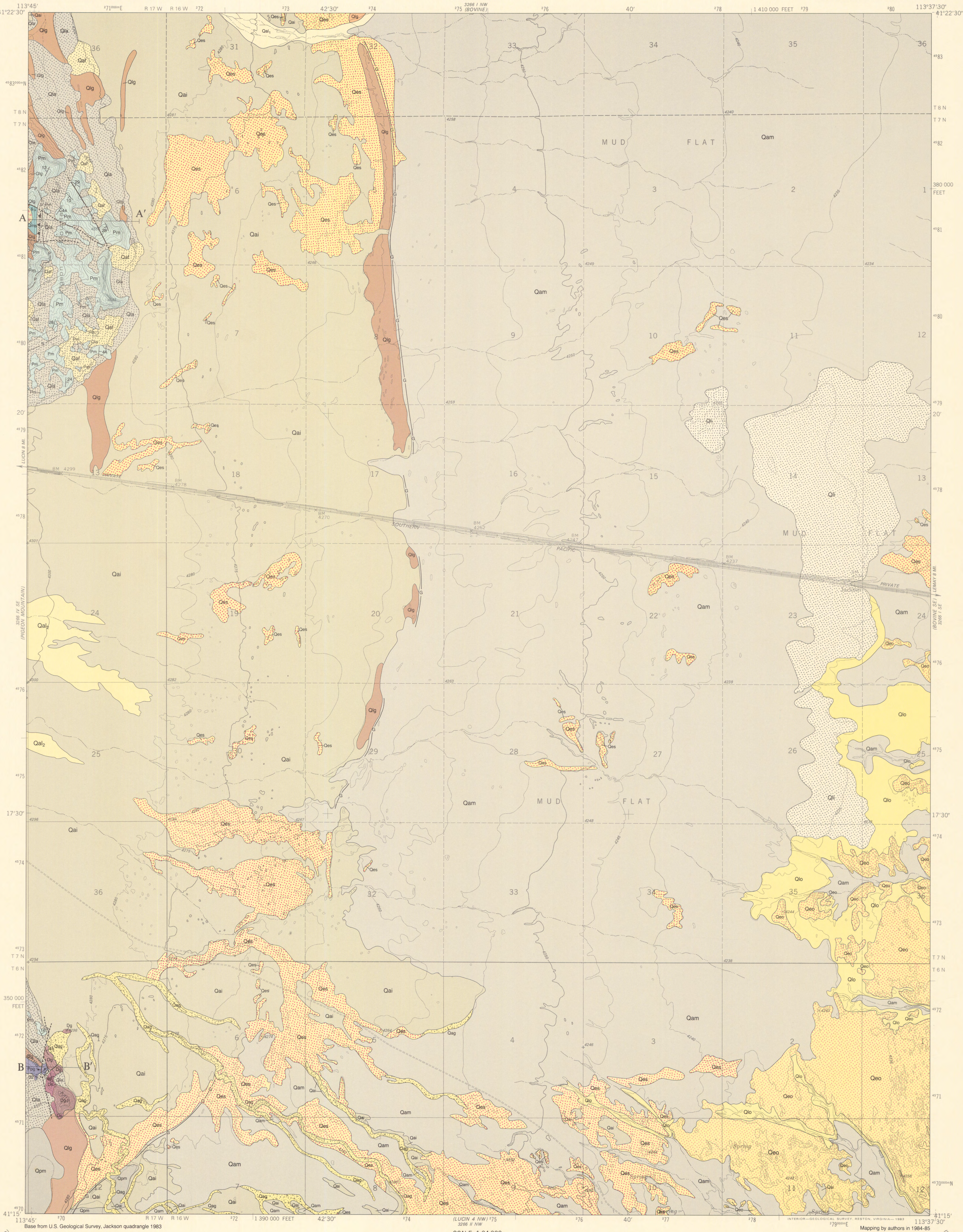

Base from U.S. Geological Survey, Jackson quadrangle 1983

Mapping by authors in 1984-85
Kent D. Brown, Cartographer

SCALE 1:24 000

CONTOUR INTERVAL 5 AND 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

UTM GRID AND 1983 MAGNETIC NORTH
DECLINATION AT CENTER OF SHEET

QUADRANGLE LOCATION

GEOLOGIC MAP OF THE JACKSON QUADRANGLE
BOX ELDER COUNTY, UTAH

by
David M. Miller and Linda L. Glick
U.S. Geological Survey

1987

UTAH GEOLOGICAL AND MINERAL SURVEY
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Dotted where covered

HIGH-ANGLE FAULT

Dashed where approximately located; dotted where covered; Bar and ball on downthrown side

LOW-ANGLE FAULT

Dashed where approximately located; dotted where covered; sawteeth on upper plate

STRIKE AND DIP OF BEDDING

50

TRACE OF LAKE BONNEVILLE SHORELINE

P

Provo - About 4835 ft (1474m) elevation

S

Stansbury - About 4510 ft (1375m) elevation

G

Gilbert - About 4265 ft (1300m) elevation

DESCRIPTION OF MAP UNITS

Qla Lacustrine and alluvial deposits, undivided—*Alluvium older than Lake Bonneville etched by erosional shorelines, and overlain by thin lacustrine gravel and sand deposits.*

Qaf Alluvial fan deposits—*Unconsolidated alluvial-fan deposits of gravel, sand, and silt; colluvium included locally.*

Qal_1 Younger Alluvium—*Unconsolidated silt, sand, and fine pebble gravel in ephemeral streams and washes, and in sheetflow deposits.*

Qes Eolian sand—*Unconsolidated tan to light-brown, fine- to medium-grained sand and tan silt, occurring as complexes of small (2 m high) vegetated dunes or as broad sheets covering fine-grained alluvial deposits. Commonly contains detrital evaporite minerals.*

Qeo Eolian oolitic sand—*White oolitic sand sheets and dunes reaching heights of 11 m. Clasts are predominantly spherical and elliptical ooids.*

Qai Alluvial silt—*Unconsolidated, tan silt, clay, and fine sand generally producing hummocky topography. Desiccation features, vegetation, and black algae are common.*

Qam Alluvial mud—*Unconsolidated clay, silt, and soluble salts in low-lying areas with characteristic development of ephemeral, low-gradient drainage systems. Deposits in the eastern half of the quadrangle include abundant salt crusts, local ooids, and sparse vegetation. Deposits in the west are covered by more vegetation (with local black algae), salt content is reduced, and no ooids occur.*

Qpm Playa mud—*Unconsolidated clay, silt, and white soluble salts in nearly level, undrained, vegetation-free plains.*

Qal_2 Older alluvium—*Unconsolidated silt, sand, and fine pebble gravel; locally includes silty floodplain deposits.*

Qag Alluvial gravel—*Tightly packed, fine to coarse pebble gravel deposited in stream channels discordant with present drainages. Maximum clast size is about 3 cm. Deposits generally form narrow, sinuous ridges.*

Qlg Lacustrine gravel and sand, undivided—*Unconsolidated gravel and sand forming shoreline deposits of Lake Bonneville. Clasts are well rounded and size-sorted, commonly with little matrix. Locally forms beachrock cemented by calcareous silt.*

Qlo Lacustrine oolite—*Light-colored, platy, cemented calcareous oolite, generally 5 to 15 cm thick, capping brown, thin-bedded, oolitic sandstone more than 1.5 m thick.*

Qli Lacustrine silt—*Dark-brown, unconsolidated silt and fine-grained sand overlying lacustrine mud. Supports moderate shrubs and black algae.*

Qms Mass movement deposits—*Landslide block characterized by hummocky topography on the east side of Pigeon Mountain. Slide debris has wave-cut notches from Lake Bonneville.*

TRu Unnamed sandstone—*Yellowish-brown calcareous siltstone and fine-grained sandstone forming slopes.*

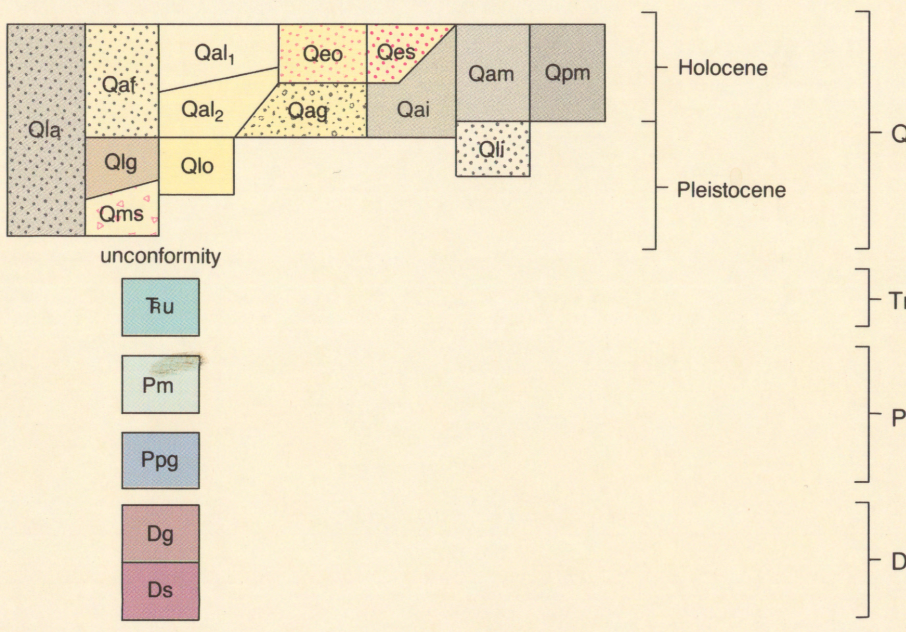
Pm Murdock Mountain Formation—*Brown and black, thin-bedded chert, brown sandstone, and gray dolomite and dolomitic sandstone. Chert locally contains as much as 50 percent carbonate as irregular pods and stringers.*

Ppg Grandeur Formation of the Park City Group—*Gray and brownish-gray, medium- to thick-bedded, cherty dolomite with thin interbeds of laminated sandstone and chert, rare limestone.*

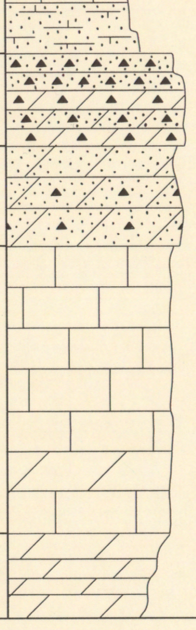
Dg Guilmette Formation—*Massive to thick-bedded, dark-gray limestone and dolomite; highly fractured.*

Ds Simonson Dolomite—*Medium-bedded, black and gray dolomite. Some beds laminated.*

CORRELATION OF MAP UNITS



FORMATION	SYMBOL	THICKNESS feet (meters)	LITHOLOGY
Unnamed sandstone	TRu	300 (90)	
Murdock Mountain Formation	Pm	330 (100)	
Grandeur Formation	Ppg	345 (105)	
Guilmette Formation	Dg	990 (300)	
Simonson Dolomite	Ds	285 (85)	



Ppm Meade Peak Phosphatic Shale Tongue of the Phosphoria Formation—*Black and brown, fissile shale and siltstone with subordinate interbedded dolomite and sandstone.*