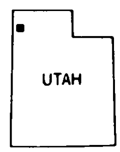
GEOLOGIC MAP OF THE PIGEON MOUNTAIN QUADRANGLE, BOX ELDER COUNTY, UTAH

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



UTAH GEOLOGICAL AND MINERAL SURVEY
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UTAH GEOLOGICAL AND MINERAL SURVEY

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INTRODUCTION

The Pigeon Mountain quadrangle in northwestern Utah (figure 1) includes lowlands of the Great Salt Lake Desert, the northern end of the Little Pigeon Mountains, and most of Pigeon Mountain. In the northwest corner of the quadrangle is one of several hills near the town of Lucin. The summit of Pigeon Mountain, at an elevation of 1645 m (5396 feet), is the highest point in the quadrangle. Surrounding the mountains is flatland that slopes gently to the east and south; it ranges in elevation from 1372 m (4500 feet) to 1309 m (4294 feet).

Mountainous parts of the Pigeon Mountain quadrangle are underlain by Permian sedimentary rocks of the Cordilleran miogeocline. These strata, which accumulated under shallow-marine conditions on the ancient continental shelf, are generally similar to those exposed at Lemay Island to the south and in the Pilot Range about 6 km to the west (Miller, 1984), but they differ in important respects from those exposed to the north at Bovine Mountain (Jordan, 1979), and to the east in the Newfoundland Mountains (Allmendinger and Jordan, 1984). 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 virtually 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.

The only previous geologic study in the quadrangle is Doelling's (1980) small-scale mapping. Companion reports to this one are the Lemay Island, Jackson, and Lucin 4 NW quadrangles shown in figure 1 (Miller and Glick, 1986; 1987; Glick and Miller, 1986); the neighboring Lucin quadrangle to the west was published by Miller (1985). Rocks a short distance to the north in Bovine Mountain (figure 1) were described by Jordan (1979, 1983).

DESCRIPTION OF UNITS

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 in the Little Pigeon Mountains. The Grandeur Formation has 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.

Meade Peak Phosphatic Shale Tongue of the Phosphoria Formation

Between the Murdock Mountain Formation (exposed in the Jackson quadrangle; Miller and Glick, 1987) and the Grandeur Formation in the Little Pigeon Mountains are fragmentary exposures of the Meade Peak Phosphatic Shale Tongue of the Phosphoria Formation (Pmp). Black siliceous siltstone, shale, and chert are exposed in drainages cutting lake gravel; rocks in the exposures are stratigraphically above the Grandeur Formation, although the contact is not exposed. Thick beds of medium-gray dolomite occur within the shaly sequence, and locally abundant float of tan calcareous siltstone suggests that part of the unit contains that rock type.

Tongue of Gerster Limestone

About 80 m (260 feet) beneath the top of the Murdock Mountain Formation is a 3-m-thick section of limestone assigned to the upper tongue of the Gerster Limestone (Pgt) as defined in the Leach Mountains, Nevada (Miller and others, 1984). The limestone in the Gerster tongue is light gray, thick-

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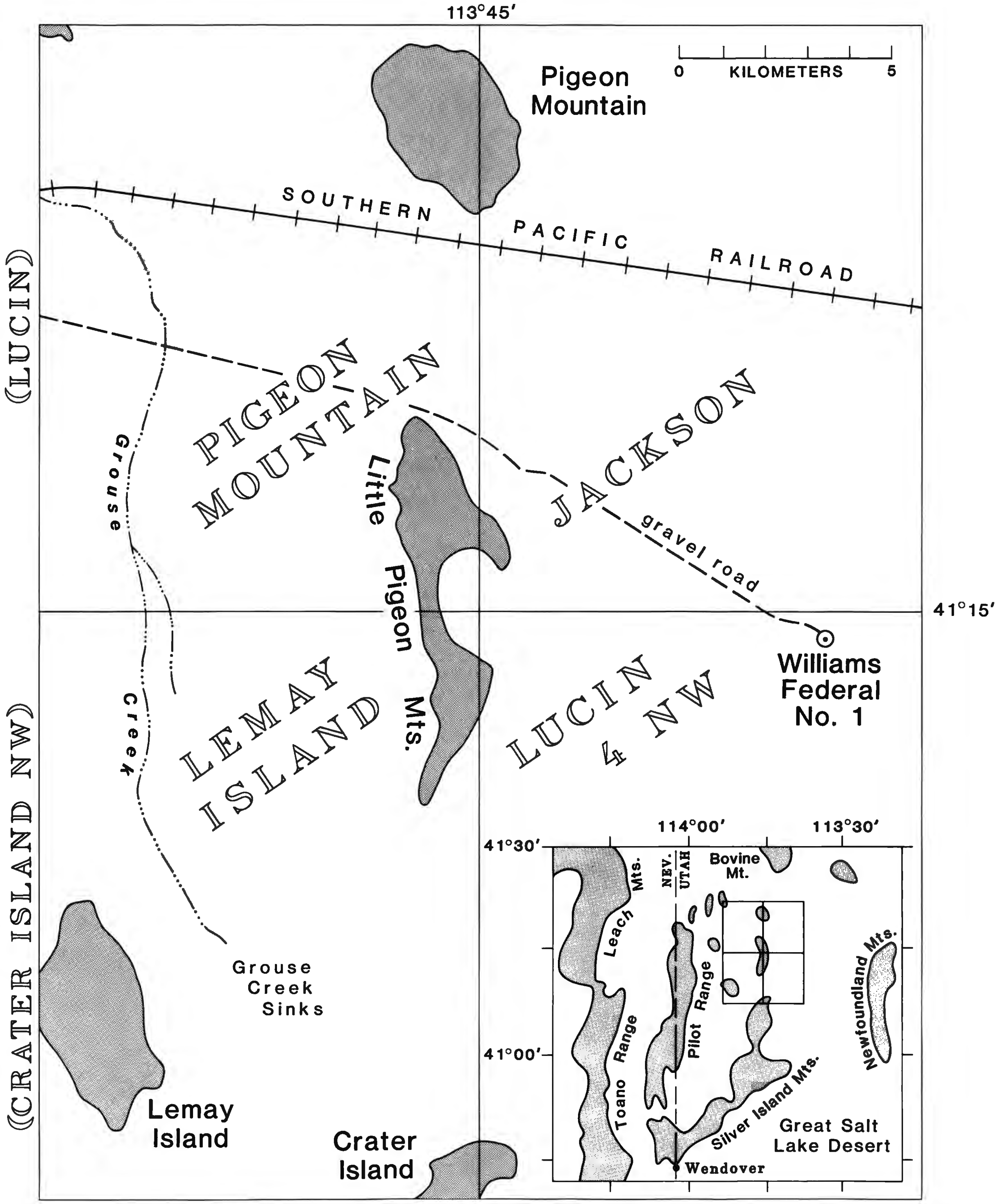

Figure 1. Location map showing mountains (shaded areas) and cultural features in the Lemay Island, Pigeon Mountain, Jackson, and Lucin 4 NW quadrangles, and location of quadrangles in northwest Utah.

bedded, coarse-grained, and shelly; one bed contains abundant productid brachiopods. Beds in the Gerster tongue are locally dolomitized, and the brachiopods locally altered to dark-gray siliceous "chert" balls. On the basis of lithologic correlation with the sections in the Leach Mountains (Miller and others, 1984) and Lemay Island (Miller and Glick, 1986), and on faunal data (table 1, location 2), the Gerster Limestone tongue is early Quadalupian (Wordian; late Early Permian).

Murdock Mountain Formation

The predominant rock type in the Permian Murdock Mountain Formation (Pm) 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 upper part of the Murdock Mountain, 80 m (260 feet) beneath the unnamed Triassic sandstone, is a 3-m-thick tongue of the Gerster Limestone. Locally, a thick bed of shelly limestone lies about 20 m (66 feet) below the Gerster tongue. Above the Gerster tongue are 49 m (160 feet) of cliff-forming, thin-bedded black and brown chert, within which distinctive irregularly shaped blebs of dolomite occur, and overlying 30 m (100 feet) of slope-forming brown dolomitic sandstone with interbeds of thick, resistant chert units 1 to 2 meters thick. Resting disconformably on the Murdock Mountain is about 2 m (6 feet) of Triassic calcareous siltstone and silty limestone. Rocks at the contact between Triassic strata and the Murdock Mountain Formation show no sign of tectonic disturbance, and thus the contact is interpreted as a disconformity. The Permian Gerster Limestone, which normally rests on the Murdock Mountain Formation, evidently was eroded before deposition of the Triassic strata.

In stratigraphic sections exposed farther south in the quadrangle in the Little Pigeon Mountains, and at Lemay Island (figure 1; Miller and Glick, 1986), and in the Leach and Cassia Mountains (Miller and others, 1984; Mytton and others, 1983), the Murdock Mountain Formation is underlain by the Meade Peak Phosphatic Shale Tongue of the Phosphoria Formation and overlain by the Gerster Limestone. A tongue of the Gerster Limestone occurs in the upper part of the Murdock Mountain at Pigeon Mountain and Lemay Island; in other ranges in the area two tongues of the Gerster occur in the upper part of the Murdock Mountain (Wardlaw and Collinson, 1979; Miller and others, 1984). In Pigeon Mountain the structural complexity and variable silicification make detailed subdivision of the cherty Murdock Mountain difficult.

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 consistency with the neighboring Lemay Island quadrangle 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. Two fossil samples from the Murdock Mountain Formation at Pigeon Mountain support an early Guadalupian age for the upper part of the formation. The tongue of Gerster Limestone contains early Guadalupian brachiopods (table 1, location 2), and a thin limestone bed about 6 m (20 feet) below the top of the formation contains sparse conodonts of possible Guadalupian age (table 1, location 3).

TRIASSIC ROCKS

A slope-forming unit of calcareous sandstone (ŦRu) about 90 m (300 feet) thick occurs as a fault block between two sections of the Murdock Mountain Formation in Pigeon Mountain. This unit, the unnamed sandstone, is composed mainly of tan to yellow, platy to thin-bedded, calcareous sandstone and siliceous siltstone. In the upper one-half of the exposed interval, medium to thick beds of resistant, medium-gray silty and sandy limestone are present. Crinoidal debris and brachiopods occur in some of the limestone beds. Limestone beds are highly siliceous near the top of the section. Conodonts from one limestone bed in this unit are Early Triassic (table 1, location 4). 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.

Resting unconformably on the Permian Murdock Mountain Formation 1 km north of the peak of Pigeon Mountain is a thin (2 m; 6 feet) sequence of yellowish tan calcareous sandstone and siltstone and medium-gray silty limestone containing crinoid, brachiopod, and bryozoan fragments. Conodonts recovered from limestone beds within this unit are Triassic in age (table 1, location 1). It is lithologically similar to parts of the thicker sections of the unnamed sandstone unit exposed in Pigeon Mountain.

QUATERNARY DEPOSITS

Alluvial deposits, in part reworked from late Pleistocene sediments of Lake Bonneville, are the predominant surficial deposits in the quadrangle. Old graded roads and the Southern Pacific Railroad maintenance road provide access for detailed studies. Quaternary units were mapped primarily through field investigations, although relatively inaccessible areas were mapped by extrapolation of known outcrops on aerial photographs.

Although the majority of the quadrangle was covered by Lake Bonneville, the lake deposits were reworked by alluvial and fluvial processes. Remaining lacustrine deposits were formed chiefly at shorelines prominent in Pigeon Mountain. The best developed wave abrasion platform, which is as wide as 5 m (15 feet), is at the Provo Shoreline at an elevation of 1474 m (4835 feet). Immediately below this level are heavily coated beach rock deposits. The Bonneville wave abrasion platform is at an elevation of about 1585 m (5200 feet). Not as well defined is a small Stansbury Shoreline terrace at an elevation of about 1375 m (4510 feet). The elevation of the Stansbury Shoreline at Pigeon Mountain closely matches the reported Stansbury Shoreline from the margin of the Bonneville basin, but the Provo and Bonneville Shorelines stand as much as 29 m (95 feet) higher than those measured at the margins of the basin (Currey and others, 1984). We attribute this difference to regional isostatic rebound of this region as described by Crittenden (1963).

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.

Alluvium

Alluvium is divided into an older unit (Qal_2) and a younger unit (Qal_1). Modern drainage patterns and the general topography suggest that both older and younger deposits represent a large broad fan extending from the mouth of Grouse Creek. Both deposits post-date the regression of Lake Bonneville at about 13 Ka (Currey and others, 1984).

The younger alluvium is associated mainly with the modern drainage of Grouse Creek, which flows along south-trending channels on the west side of the Little Pigeon Mountains and ends at Grouse Creek sinks (figures 1, 2). These channels and associated flood plains are ephemeral. Two-meter (6-foot) high cuts on the margin of Grouse Creek expose laminated silt and fine sand with lenticular interbeds of sand and gravel. Fine-grained beds are continuous parallel to the wash for as much as 100 m, whereas coarser lenses are at most 10 m long and 10 cm thick. Small-scale cross-lamination is ubiquitous in these deposits.

The older alluvium occurs as channel(?) deposits lying oblique to modern drainage patterns; these trend east between Pigeon Mountain and the Little Pigeon Mountains (figure 2). On aerial photographs, these deposits show patterns similar to modern alluvial channels. A south-trending, deeply incised channel at the mouth of Grouse Creek presently precludes any easterly-directed drainage.

Eolian sand

Eolian deposits (Qes) form small (2-meter-high), dune-like features in the southern part of the quadrangle and sheets on the windward side of the northern Little Pigeon Mountains. 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. Assuming westerly winds, the reworked deposits indicate that the sand has been transported less than 5 km.

Playa mud

Muds (Qpm) ponded behind ancient barrier bars (exposed east of the quadrangle) occur in the Little Pigeon Mountains. Mud in much of the flat floor of this ponded area contains soluble salts as well. Near the margin of the playa mud, silt and sand sizes predominate as a result of influx of local alluvial materials.

Alluvial-fan deposits

Alluvial-fan deposits (Qaf) along the western border of the quadrangle are extensions of the Qaf_2 unit mapped by Miller (1985) in the adjacent Lucin quadrangle, which represents fans extending from the Pilot Range. Deposits in the northern part of the quadrangle represent small fans extending from canyons in Pigeon Mountain and other hills.

Desert ripples

Ponded, fine-grained alluvial deposits separated by low, vegetated rims comprise the desert ripple unit (Qar). On aerial photographs, these deposits appear as dark, thin bands representing vegetated berms, as much as 50 cm high, behind which are light-colored, unvegetated silt and mud. The somewhat arcuate ripples generally trend northeast and are convex to the southeast. They occur primarily at the junctions of distal parts of coalesced fans and the relatively flat ancient lake floor. Wells and Dohrenwend (1985), described somewhat similar, but generally much smaller, features in the Mojave and Sonoran Deserts, and attributed them to sheetflood processes. Such a mechanism is likely for the ripples in the Pigeon Mountain quadrangle and elsewhere in the Lake Bonneville region (Oviatt, 1985, written commun.). Previously, Ives (1946) suggested that desert ripples formed by eolian processes. In comparison with ripples described by Ives (1946) and Wells and Dohrenwend (1985), the desert ripples in the Pigeon Mountain quadrangle are unusually large, showing a typical spacing between dark berms of about 20 m (70 feet); and a maximum of 60 m (200 feet).

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 and may include reworked and partly obliterated desert ripples.

Alluvial gravel

Gravel ridges (Qag) grading laterally into, and overlain by, fine-grained alluvium probably represent stream-channel deposits. They are composed of gravel in lenses having long axes parallel to the ridges. Imbrication and cross-bedding indicate transport to the south and east. Gravel deposits related to the Grouse Creek drainage comprise south-trending ridges along the west side of the Little Pigeon Mountains (QagS) and east-trending ridges north and east of the Little Pigeon Mountains (QagE) as shown in figure 2. The relative age of these two groups of gravel deposits is uncertain, but QagS is probably younger than QagE by an unknown amount of time. The only lithologic difference between the two groups is that the eastern group has a greater amount of matrix and generally smaller clast size and thus was probably deposited by lower energy streams. The deposits form sinuous traces mimicking meandering stream channels, and presently form slightly raised ridges showing topographic inversion due to the contrasting erosional resistances between the gravel and the surrounding fine-grained alluvium. Younger drainage systems cross the gravel ridges and locally dissect them.

The coarseness of the alluvial gravel deposits contrasts strongly with adjacent silt deposits and modern alluvial chan-

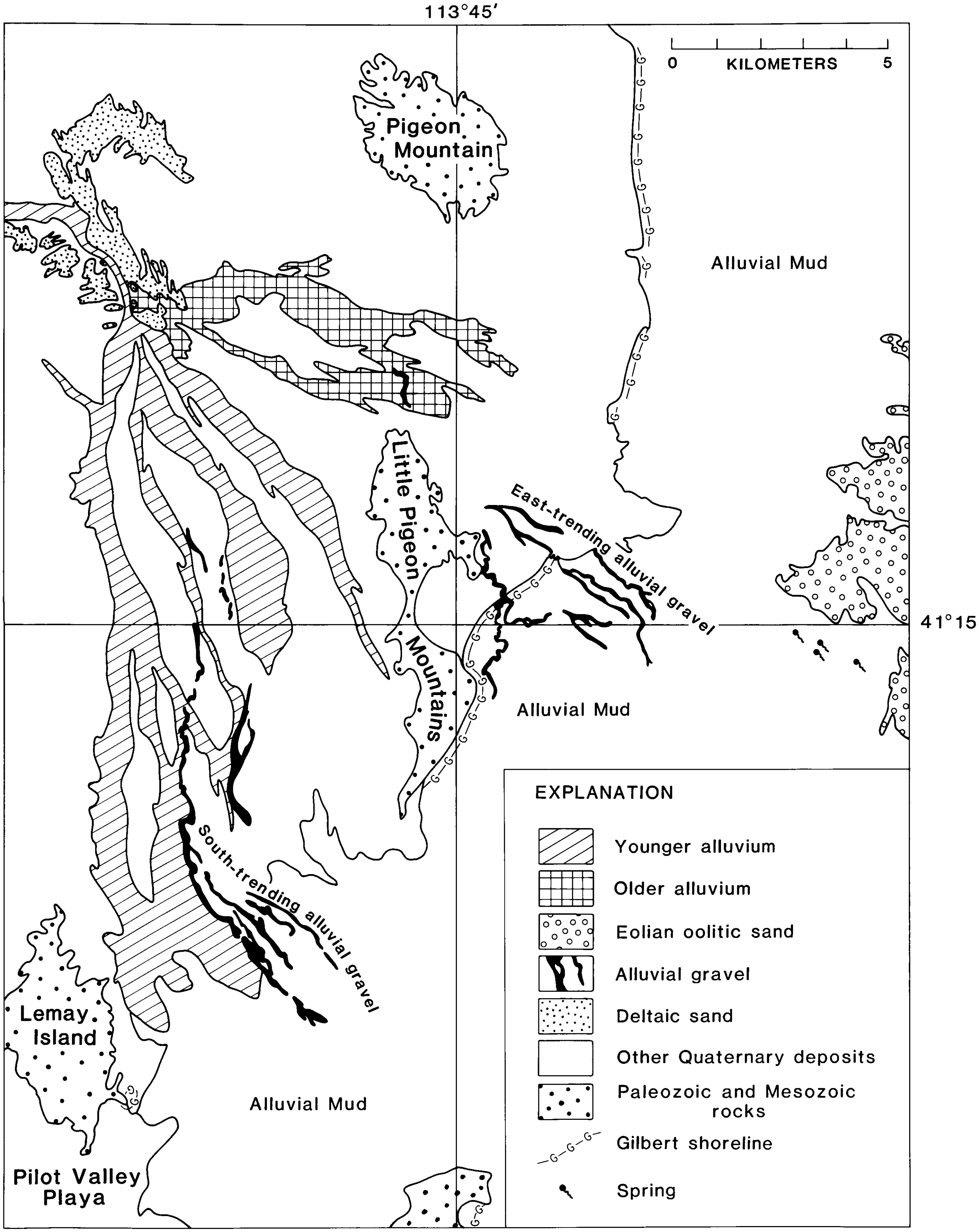

Figure 2. Map showing distribution of selected Quaternary deposits in the Lemay Island, Pigeon Mountain, Jackson, and Lucin 4 NW quadrangles. Area of map corresponds to figure 1.

nel deposits. The gravel deposits possibly represent deposition shortly after the withdrawal of Lake Bonneville or during the Gilbert cycle, when conditions were different from the present warm and dry cycle. Later erosion by sheetflow and by eolian deflation produced the topographic inversion.

Alluvial gravel deposits (Qag) not related to Grouse Creek occur west of Pigeon Mountain; these form straighter and broader ridges than the deposits associated with Grouse Creek. The gravel west of Pigeon Mountain was deposited under lower energy conditions as indicated by 3-cm-sized clasts and abundant matrix.

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.

Deltaic sand

Veneers and thick sheets of tan sand (Qds) forming platforms in the northwest part of the quadrangle are spatially associated with a cuspate delta complex now dissected by the main channel of Grouse Creek. The deltaic sand deposits form north- and northeast-trending finger-like projections that conform to the contours of the cuspate delta. Along the Southern Pacific Railroad in section 12, T. 7 N., R. 18 W., exposures extend from about the level of the railroad track to a hill top at an elevation of 1366 m (4483 feet), giving an estimated thickness of the unit of 15 m (50 feet). About 1.5 km (1 mile) south of this exposure the sand deposits are morphologically similar but occur only as caps and veneers overlying thicker silt deposits.

In the Pigeon Mountain quadrangle and the adjacent Lucin quadrangle, the deltaic sand deposits overlie a poorly exposed sequence of silty to sandy, and locally pebbly, lacustrine deposits. These deposits cannot be distinguished from alluvial deposits in many areas because both are covered by a mantle of reworked alluvial and lacustrine deposits (Qla). In good exposures, the fine-grained lacustrine deposits are similar in texture and bedding to the deltaic underflow-fan deposits described elsewhere in the Bonneville basin by Oviatt (1984, p. 13).

STRUCTURAL GEOLOGY

Structures in the Pigeon Mountain quadrangle predate Quaternary surficial deposits that comprise 90 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 nearby ranges.

LITTLE PIGEON MOUNTAINS

Strata in the Little Pigeon Mountains within the Pigeon Mountain quadrangle dip generally eastward, with steep dips in the western part of the mountains giving way to shallower dips in the east (section AA′). No major faults occur in these mountains, but beds in the Meade Peak Tongue are offset one to three meters by each of several minor northwest-striking faults dipping steeply east.

PIGEON MOUNTAIN

Strata at Pigeon Mountain define a broad, north-trending anticline whose crest is near the geographic center of the mountain. The strata are cut by low-angle faults that are approximately parallel to bedding and by moderate-angle faults striking north and west-northwest. 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.

Some of the low-angle faults at Pigeon Mountain are cryptic bedding-plane faults within the Murdock Mountain Formation. Local breccia zones within cherty rocks of this formation on the southwest part of Pigeon Mountain mark zones of movement along bedding planes. A nearly horizontal fault exposed just above the Provo Shoreline beach terrace along the southern portion of cross section B-B′ is characterized by a white calcite-rich zone that cuts bedding at a slight angle. One exposure shows well-layered chert placed above massive chert, whereas other exposures place chert above limestone-rich chert. Strata are relatively undisrupted near the faults. Such faults may have developed as part of a disharmonic response to folding of the stiff, cherty Murdock Mountain Formation.

Other low-angle faults at Pigeon Mountain apparently had large separations because they juxtapose different rock units. The Murdock Mountain Formation occurs in two structural blocks, each containing structural remnants of the tongue of the Gerster Limestone. Between these two structural blocks is a fault-bounded slice of Triassic strata. Northward, the low-angle faults truncate the Triassic strata and the Gerster tongue in the block above these strata (section BB′). Structural slices of Permian and Triassic rocks noted by Todd (1983) in the Matlin Mountains, northern Utah, may be akin to those at Pigeon Mountain.

The several low-angle faults and repeated strata exposed in Pigeon Mountain may represent a group of fault slices within a thrust duplex. At least one of the thrusts had more than 5 km of separation to account for the repeated strata. Fault slices in duplexes commonly are folded, which is consistent with the roughly north-trending broad fold composing all of Pigeon Mountain. Moderate-angle faults that displaced the folded strata perhaps belong to an episode of Cenozoic upper crustal extensional tectonism.

Moderate- to high-angle faults cutting the Murdock Mountain Formation are generally marked by resistant, silicified breccia in zones 1 to 3 m wide. Less commonly, wide bands of coarsely fibrous calcite occur along the fault traces. Two sets of these faults occur, one striking west-northwest and the other about north-northwest. Three normal faults with west-northwest strike were mapped; of these, the most prominent fault dips about 50° south and shows stratigraphic separations of about 100 m. Three normal faults strike north-northwest and dip moderately to steeply east. They cut the west-northwest faults, and in one carefully mapped fault intersection the north-striking fault shows a throw of about 50 m.

Breccia zones less continuous than those associated with the moderate-angle faults are common at Pigeon Mountain. Many breccia zones have northwest-trending surface traces. Cherty rocks throughout most of the mountain are moderately fractured.

One kink fold in the Murdock Mountain Formation was observed. Its limbs are about 10 m between fold hinges, and the fold axis plunges N. 60° W. at about 25 degrees. The fold occurs in rocks a few tens of meters above the low-angle fault placing Gerster Limestone on the unnamed sandstone.

STRUCTURAL CONFIGURATION OF THE BASINS

On the basis of gravity and seismic refraction studies, Berg and others (1961) and Cook and others (1964) concluded that the lowland separating outcrops of Paleozoic strata in the Pigeon Mountain quadrangle is primarily underlain by Cenozoic deposits 2000 to 7000 feet thick. They estimated that the basin west of the Little Pigeon Mountains contains an asymmetric, eastward-thickening sequence of Tertiary and Quaternary strata about 7000 feet thick. Several faults create steps in the pre-Tertiary basement on the west side of the basin but the largest fault apparently is at the east side. Cook and others (1964) noted that the Little Pigeon Mountains are structurally continuous with Pigeon Mountain, and that the intervening "buried range" is probably at shallow depths; the data are inadequate to estimate this depth accurately. On the other hand, the rock units and structures in the two ranges differ, suggesting that major faults lie between the ranges. A saddle-shaped pattern of gravity contours west of Pigeon Mountain may, they concluded, represent a buried fault-block spur between Pigeon Mountain and bedrock hills near the town of Lucin, one of which occurs in the extreme northwestern corner of the Pigeon Mountain quadrangle. Underlying Cenozoic deposits are probably down-faulted upper Paleozoic strata.

HYDROLOGY

Grouse Creek presently discharges along south-directed channels west of the Little Pigeon Mountains before splitting into several channels near the southern border of the quadrangle. From the fan-shaped contour lines at elevations between 4340 and 4400 feet, it appears that a deltaic and(or) fan complex formed and the present drainage is following but one of several possible channels below about 4400 feet elevation. In contrast to the present drainage of Grouse Creek to the south, the slightly deeper ground water probably flows southeast along channels north of the Little Pigeon Mountains as indicated by the presence of several springs in the Lucin 4 NW quadrangle (figure 2). The ground water source for these springs most plausibly is up the topographic gradient (northwest). Drainage of Grouse Creek at post-Bonneville high stand times produced gravel channels east of the Little Pigeon Mountains (figure 2), and pre-Bonneville drainage also may have been in this area. The old gravel channels probably control the shallow ground-water flow. It is also possible that a buried ridge of Tertiary strata west of the Little Pigeon Mountains diverts ground water east and north of the mountains; data are not able to prove or disprove this hypothesis.

ECONOMIC DEPOSITS

No mines or prospect pits were observed in the Pigeon Mountain quadrangle during mapping, nor were any described in a recent compilation of the economic geology of Box Elder County by Doelling (1980). Three 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 Grandeur and Murdock Mountain Formations show replacement of sandstone or carbonate rock by silica and therefore have potential for gold resources.

(2) Nearby in the Leach Mountains (Miller and others, 1984) and elsewhere in the region (Maughan, 1979), the Meade Peak Phosphatic Shale Tongue of the Phosphoria Formation bears significant phosphate resources. The Meade Peak is shallowly buried by alluvium and lacustrine deposits in the Little Pigeon Mountains. Two grab samples of black siliceous shale and siltstone yielded 1 percent or less P_2O_5, which is an uneconomic grade (Fedewa, 1980). Phosphatic oolite, the lithology with highest P_2O_5 in the Leach Range, was not observed in the quadrangle. The results suggest low potential for significant phosphate resources in the Little Pigeon Mountains.

(3) Gravels that accumulated in beaches and tombolos at Pigeon Mountain and in the Little Pigeon Mountains are possible sources of construction material. Three of the mapped lacustrine gravel deposits have been excavated for local use. These include a gravel pit at Lucin Hill in the very northwest corner of the quadrangle, the Lucin pit along the bar extending southwest from Pigeon Mountain, and a gravel pit at the northernmost tip of the Little Pigeon Mountains.

GEOLOGIC HAZARDS

Flooding caused by locally heavy precipitation or sustained areal precipitation is a major hazard in the Pigeon Mountain quadrangle. The roughly 85 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. Somewhat higher-than-average precipitation in northwest Utah and northeast Nevada, such as occurred during early 1984, can create sufficient runoff in the watershed of Grouse Creek to cause flooding. The low topographic gradients in the Pigeon Mountain quadrangle promote the distribution of waters along meandering channels and as sheetfloods, making it difficult to predict flood locations.

Partly vegetated and unstable eolian sands, which are more than 1 m thick in about 5 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 14 km (8 miles) west of the Pigeon Mountain quadrangle, 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 Pigeon Mountain area.

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TABLE 1. Paleontology data for the Pigeon Mountain quadrangle

Map No.	Field No. (USGS No.)	Rock unit and Fossil age	Date of Report	Paleontologist	Faunal Description	Location Latitude	Location Longitude
1	M84PI-07	Unnamed sandstone Triassic	4/85	John Repetski, Bruce R. Wardlaw and W.C. Sweet	Verbal report that conodonts are Triassic, position uncertain.	41°21'34"	113°45'19"
2	M84PI-06 (29318-PC)	Tongue of Gerster Limestone Middle Wordian (late Early Permian)	8/23/84	Bruce R. Wardlaw and J.T. Dutro	*Thamnosia depressa* Cooper *Bathymyonia* sp. A *Waagenoconcha?* sp. *Rugatia?* sp. This collection of productoid brachiopods represents the "Gerster fauna" and is common to a tongue of the Gerster Limestone of the Murdock Mountain Formation in the nearby ranges of Nevada and a tongue of the Gerster Limestone in the Plympton Formation farther south along the Nevada-Utah border. This is the *Thamnosia* Zone of Wardlaw and Collinson (1979). In the type section of the Murdock Mountain Formation in the Leach Mountains, there are two prominent ledge-forming limestone tongues of the Gerster Limestone within the upper part of the Murdock Mountain Formation: the lower, the "bryozoan" tongue, and the upper, the *Thamnosia* tongue. The fauna of this collection is exactly that of the *Thamnosia* tongue.	41°21'30"	113°45'22"
3	M85PI-04 (29624-PC)	Murdock Mountain Formation Early Permian	4/24/85	John Repetski and Bruce R. Wardlaw	aff. *Stepanovites festiva* (Bender & Stoppel) 1 M element 1 ?Pb element 1 Sa element 1 Sb element 2 Sc elements The species-diagnostic Pa and Pb elements of the single apparatus recovered here were not found. *S. festiva* is known from upper Leonardian through Roadian strata. The descendants of *S. festiva, Merrillina galeata* (Bender & Stoppel) and *M. divergens* (Bender & Stoppel) have their known ranges within Wordian (=lowest Guadalupian). Because the Sa, Sb, Sc, and M elements of these three species are indistinguishable (Wardlaw and Collinson, 1984), the conservative age range for this sample is upper Leonardian through Wordian.	41°21'31"	113°45'18"
4	M84PI-08 (MES-33264)	Unnamed sandstone early Early Triassic	4/24/85	John Repetski and Bruce R. Wardlaw	*Ellisonia* sp. 5M(?) elements 2 Sb elements 1 Sa element *Hindeodus typicalis* (Sweet) 6 Pa elements 5 Pb elements 1 M element 3 Sb elements 7 Sc elements *?H. typicalis* (Sweet) 3 Pa elements (fragments) 1 unassigned element *H. typicalis* is found as low as the highest Permian on other continents but is known only from the Greisbachian in the western U.S. It occurs in the Dinwoody Formation in Idaho and Wyoming. This species is characteristic of shallow water biofacies.	41°21'08"	113°45'18"

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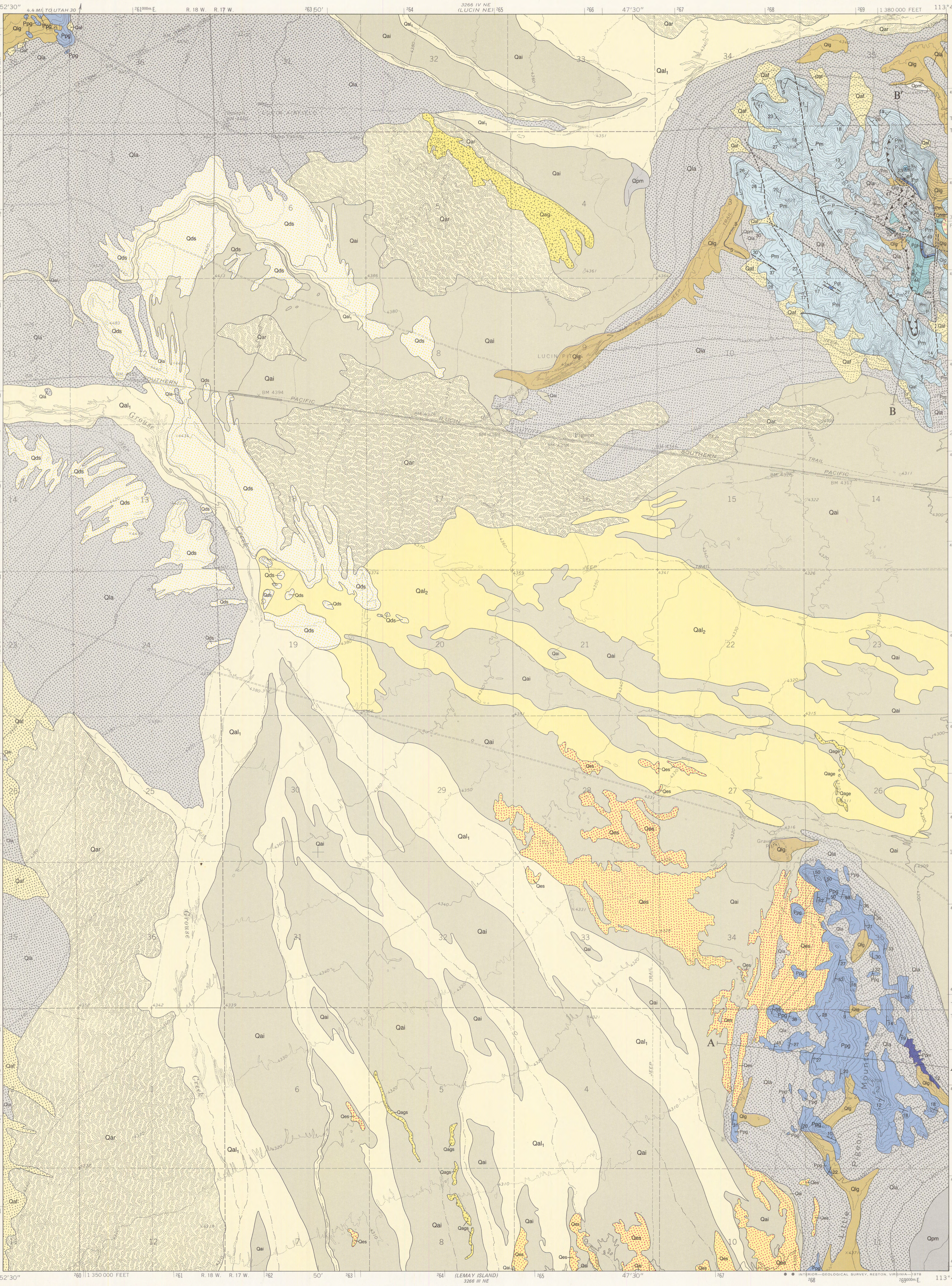
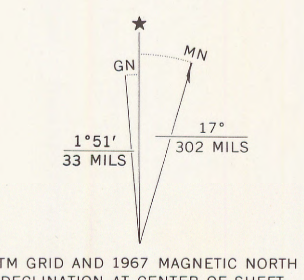


Base from U.S. Geological Survey, Pigeon Mountain quadrangle 1967



UTM GRID AND 1967 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

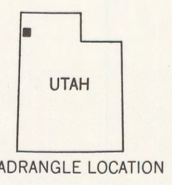
SCALE 1:24 000

1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 KILOMETER

CONTOUR INTERVAL 20 FEET
DOTTED LINES REPRESENT 10-FOOT CONTOURS
NATIONAL GEODETIC VERTICAL DATUM OF 1929



QUADRANGLE LOCATION

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

GEOLOGIC MAP OF THE PIGEON MOUNTAIN QUADRANGLE BOX ELDER COUNTY, UTAH

by

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

1987

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CONTACT

Dotted where covered

HIGH-ANGLE FAULT

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

LOW-ANGLE FAULT

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

STRIKE AND DIP OF BEDDING

TRACE OF LAKE BONNEVILLE SHORELINE

Provo - About 4835 ft (1474m) elevation

Stansbury - About 4510 ft (1375m) elevation

LOCATION OF PALEONTOLOGICAL SAMPLE

DESCRIPTION OF MAP UNITS

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

Qla Lacustrine and alluvial deposits, undivided—*Alluvium older than Lake Bonneville etched by erosional shorelines, and thin lacustrine gravel and sand deposits. Includes fine-grained deltaic deposits overlain by marl and alluvial deposits in northwest part of quadrangle; locally includes white marl in recesses of Pigeon Mountain. Includes thicker lacustrine deposits south of Pigeon Mountain.*

Qal$_1$ Younger alluvium—*Unconsolidated silt, sand, and fine pebble gravel in ephemeral streams and washes. Locally includes floodplain 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) dunes or broad sheets covering fine-grained lacustrine and alluvial deposits. Commonly contains detrital evaporite minerals. Most small dune complexes are vegetated.*

Qai Alluvial silt—*Unconsolidated deposits of tan silt, clay, and fine-grained sand, generally flat-lying but locally forming eolian mounds less than one meter high. Desiccation features, vegetation, and black algae are common.*

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

Qar Desert ripples—*Light-colored silt ponded behind dark-colored, vegetated sand and silt ridges that form a ripple pattern. Typically occur near the intersections of distal alluvial fans and fine-grained alluvium deposited on the ancient lake bottom.*

Qal$_2$ Older alluvium—*Unconsolidated silt, sand, and fine pebble gravel in abandoned streams and washes; also represents sheetwash deposits.*

Qag Alluvial gravel—*Narrow, sinuous deposits of fine to coarse pebble gravel containing approximately 10 to 40 percent silt matrix, and deposited by stream channels discordant with present drainage systems. Deposits form dark-colored, pebble-strewn ridges.*

Qags Alluvial gravel in deposits that typically trend south—*Maximum clast size is about 5 cm diameter.*

Qage Alluvial gravel in deposits that typically trend east—*Maximum clast size is about 3 cm diameter.*

Qds Deltaic sand—*Tan to brown, poorly size-sorted, medium-grained sand containing abundant sand-sized evaporite minerals and coarse igneous fragments. Forms cuspate ridges and platforms.*

Qlg Lacustrine gravel and sand, undivided-*Unconsolidated gravel and sand forming shoreline deposits of Lake Bonneville. Clasts are well rounded and size-sorted. Locally includes beachrock cemented by calcareous silt. Includes underlying marl deposits in places on Pigeon Mountain.*

Qms Mass movement deposits—*Landslide mass producing hummocky topography on the east side of Pigeon Mountain.*

TRu Unnamed sandstone—*Yellowish-brown calcareous siltstone and fine-grained sandstone forming slopes. Thick beds of medium-gray limestone, typically containing chert and crinoidal debris, form ledges in upper half of unit.*

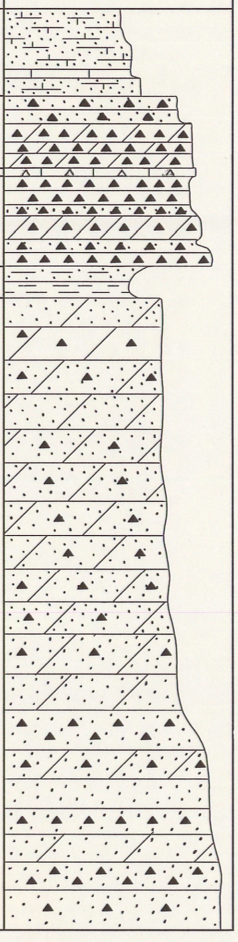
Pm Murdock Mountain Formation—*Brown, black, and white, thin-bedded chert, brown sandstone, and gray dolomite and dolomitic sandstone, typically with prominent pink to red hue. Chert locally contains as much as 50 percent carbonate as pods and layers.*

Pgt Tongue of Gerster Limestone—*Thick-bedded, gray, shelly limestone with abundant brachiopods that are in places silicified.*

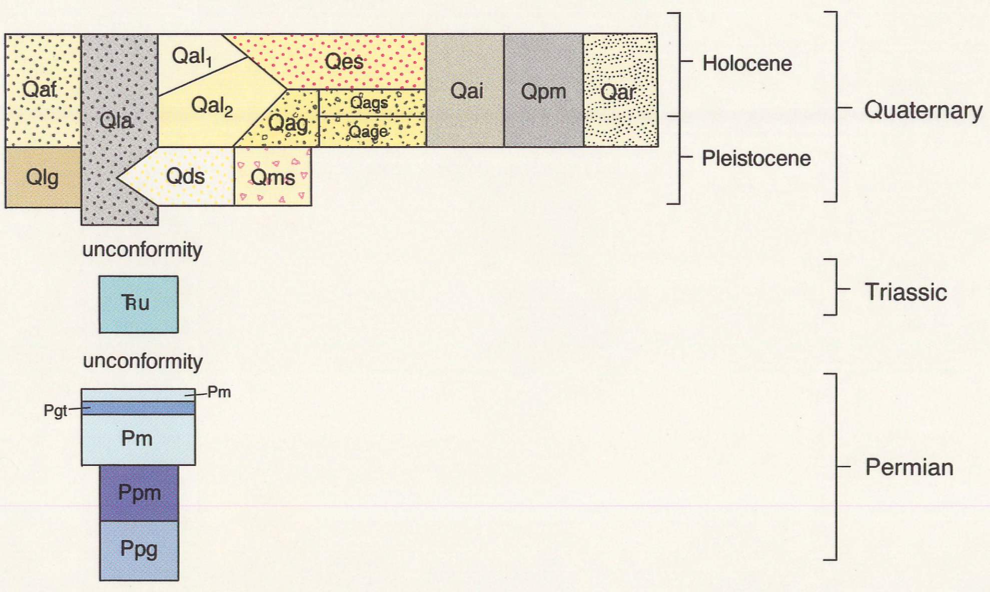
Ppm Meade Peak Phosphatic Shale Tongue of the Phosphoria Formation—*Black and brown, fissile shale and siltstone with subordinate interbedded dolomite and sandstone.*

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 bedded chert; rare limestone.*

FORMATION	SYMBOL	THICKNESS feet (meters)	LITHOLOGY
Unnamed sandstone	TRu	300 (90)	
Gerster Limestone Tongue	Pgt	10 (3)	
Murdock Mountain Formation	Pm	600 (180)	
Meade Peak Phosphatic Shale Tongue	Ppm	180 (55)	
Grandeur Formation	Ppg	2200 (670)	



CORRELATION OF MAP UNITS



Ptc Trapper Creek Formation—*Thick beds of bioclastic limestone alternating with thin beds of limestone and dolomite (shown only on cross section).*

Pbg Badger Gulch Formation—*Black, platy, silty limestone with bioclastic beds (shown only on cross section.)*