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PRELIMINARY GEOLOGIC MAP OF THE LOWE PEAK 7 1/2-MINUTE QUADRANGLE, TOOELE, UTAH, AND SALT LAKE COUNTIES, UTAH

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EXPLANATORY TEXT FOR THE PLATE, "GEOLOGIC MAP OF THE LOWE PEAK 7 1/2-MINUTE QUADRANGLE, TOOELE, SALT LAKE, AND UTAH COUNTIES, UTAH"

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Abstract

The Lowe Peak quadrangle lies on the eastern flank in the middle part of the Oquirrh Mountains. Folded and faulted Paleozoic sedimentary rocks are the upper plate of the Bingham nappe, formed by its northeastward movement on the unexposed sole Midas thrust fault during the Late Cretaceous Sevier orogeny. During transport, and folding, imbricate thrust, tear, and normal faults were formed in the nappe.

The sedimentary rocks in the nappe include the following formational units: Lynch Dolomite (Middle? and Upper Cambrian); Fitchville Formation (Lower Mississippian and Upper Devonian) and Pinyon Peak Limestone (Upper Devonian), Undivided; Gardison Limestone (Lower Mississippian); Deseret Limestone (Upper Mississippian); Humbug Formation (Upper Mississippian); Great Blue Limestone (Upper Mississippian); Manning Canyon Shale (Lower Pennsylvanian and Upper Mississippian); and the Oquirrh Group consisting of the West Canyon Limestone (Lower Pennsylvanian), Butterfield Peaks Formation (Middle Pennsylvanian), and Clipper Ridge Member of the Bingham Mine Formation (Upper Pennsylvanian).

The nappe is inferred to overlie concealed Precambrian basement rocks and the west-trending Uinta-Cortez accretionary lineament in this part of the range. Oligocene intrusive and extrusive igneous rocks were introduced into the nappe mostly along Sevier- fault structures that overlie the Uinta-Cortez zone. Base- and precious-metal vein and replacement deposits in the quadrangle include the easternmost part of the Ophir mining district and the southern part of the Bingham district. A disseminated gold prospect, similar to the deposits in the Mercur mining district has been explored in West Canyon, immediately east of the Lowe Peak quadrangle in the adjoining Tickville Springs quadrangle.

Introduction

The Lowe Peak quadrangle lies astride the high part of the south-central Oquirrh Mountains and is about 40 km southwest of Salt Lake City, Utah (fig. 1). The quadrangle lies between the Bingham Canyon quadrangle on the north, the Mercur quadrangle on the south, the Stockton quadrangle on the west, and the Tickville Springs quadrangle on the east. Lowe Peak at an elevation of 10,589 ft (3,685 m) is the highest peak in the Oquirrh Mountains. The western Traverse Mountains adjoin the Oquirrh Mountains along the northeast border of the quadrangle. The southwest corner of the quadrangle adjoins the Ophir mining district and the northeast corner covers the southern (vein and replacement deposit) area of the Bingham mining district.

The abandoned Old Mayflower mine is at the head of West Canyon and a recently explored mineralized prospect near the mouth of the Left Fork of West Canyon area occurs just off of the eastern margin of the quadrangle in the adjoining Tickville Springs 7 1/2-minute quadrangle.

This preliminary map is a status report of the geologic mapping in this quadrangle; it is more detailed in some parts than in others and supersedes an interim report by Tooker and Roberts (1988a). The geology of the Lowe Peak quadrangle has been mapped by several people (see inset on Plate 1) and this map is a compilation of their work Mapping in Middle Canyon, in the northwestern part of the quadrangle is by R.J. Roberts and E.W. Tooker; mapping in the Soldiers Creek headwaters (in Soldiers Canyon) and in the Ophir Canyon areas is by E.W. Tooker. I have relied heavily on mapping by Gilluly (1932), Moore (1973b), Swensen (1975), and Lanier (1978), for the geology of the Butterfield Canyon area in the northeastern part of the quadrangle. The details of the intrusive and extrusive rocks in the Lowe Peak quadrangle have not been reevaluated and are undivided here. The assistance of U.S. Geological Survey colleagues, R.J. Roberts, W.J. Moore, E.H. McKee, Mackenzie Gordon, Jr., R.C. Douglas, and H.M. Duncan, for map, geochronologic, and stratigraphic data is gratefully acknowledged.

Geologic setting

The folded and faulted Paleozoic sedimentary rocks that are present in the Bingham nappe overlie an inferred Precambrian basement terrane of the North American craton (Tooker and Roberts, 1988b). The nappe was emplaced in the foreland of the Sevier thrust belt during the Late Cretaceous Sevier orogeny (Armstrong, 1968). Sedimentary rocks of the upper plate are mainly. carbonaceous and siliceous clastic rocks and were deposited on the craton platform miogeocline an undetermined distance to the southwest.

The intrusive igneous rocks were introduced along or parallel with steep-dipping nappe faults as stocks, plugs, dikes, and sills during the Oligocene. They consist mainly of porphyritic quartz monzonite-granodiorite and rhyolite centered in the Bingham mining district (Lanier and others, 1978); but they also are scattered southwestward in the northern part of the Lowe Peak quadrangle along northeast-trending faults towards the Stockton mining district. The extrusive flows and breccias of Oligocene age (Moore, 1973a), which generally postdate the intrusions are found mainly in the northeastern part of the quadrangle and eastward into the western Traverse Mountains. They consist of latite, latitic tuff breccia, latite breccia, rhyolite, and andesite flows, and laharic breccia composed of clasts of these volcanic lithologies (Moore, 1973b). The igneous rocks, Tv and Ti, have not been subdivided on the map.

The base- and precious-metal ore deposits in the quadrangle are, for the most part, spatially related to the intrusions as fissure fillings and replacement mantos in the southern part of the Bingham district and the eastern part of the Ophir district, just off the map in the Stockton quadrangle. Low-grade disseminated gold, which is similar to the Mercur deposits (Kornze, 1984), has been prospected for in the Lion Hill area of the Ophir mining district, and on Long Ridge at the mouth of the Left Fork of West Canyon. Both areas are immediately off the Lowe Peak in the adjoining Mercur and Tickville Springs quadrangles, respectively.

Geologic structures in the Bingham nappe

The Oquirrh Mountains are in the eastern part of the Great Basin within the Basin and Range physiographic province. This region is characterized by internal drainage, narrow, north-trending, block-faulted mountain ranges, and bordering alluvial-filled basins. The exposed rocks of the Oquirrh Mountains are composed of a thick sequence of miogeoclinal sedimentary rocks that were thrust eastward as nappes over a Precambrian basement terrane (Tooker, 1970, 1971, 1983), and possibly its overlying thin Paleozoic shelf sequence, during the Late Cretaceous Sevier orogeny. The basement terranes concealed here are the presumed extension of rocks exposed in the Wasatch Mountains. These include the Archean Wyoming Shield rocks exposed on the north side of the Uinta Mountains, which were overlapped by the accretion of Proterozoic craton shelf rocks from the south (Beutner, 1977; Tooker and Roberts, 1988a). The accretion zone is the locus of a Precambrian structural flaw or lineament zone, the Uinta-Cortez zone of Roberts and other, (1965) or Uinta trend of Tooker (1992a). This zone has been projected westward under the Oquirrh Mountains in the vicinity of the Lowe Peak quadrangle (fig 1) and is also the locus of a series of intrusive and extrusive rocks (Moore and McKee, 1983).

The exposed rocks in the Lowe Peak quadrangle are folded and faulted Bingham nappe sedimentary and igneous rocks (Tooker and Roberts, 1970). Northeastward movement of the Bingham nappe on the concealed basal Midas thrust fault (Tooker and Roberts, 1988b) produced prominent west northwest-trending, asymmetrical to locally overturned arcuate folds. A system of prominent northeast-trending, steeply dipping, normal faults resulted from tension in these arc-stretched folds. The nappe was also sheared by imbricate thrust faults, which have more limited movement than that on the sole Midas thrust. Asymmetrical to overturned smaller folds were produced along parts of the lead edges of these imbricate thrusts, seen locally on the upper plates of the Middle Canyon-Butterfield Pass, West Canyon, and Manning imbricate thrusts in the Lowe Peak quadrangle. These thrust faults are offset by differential movement along tear and normal faults. The walls of tear faults in Ophir Canyon seem to have different directions of movement; the westernmost motion represents that along the Manning thrust, whereas that in the upper reaches of the canyon represent motion related to differential movement in the underlying part of the nappe. Basin and Range extension along a north-south direction in the region reactivated some of these earlier normal and tear faults.

Stratigraphy and description of map units

The Bingham nappe consists of early to late Paleozoic clastic carbonaceous and siliceous sedimentary rocks; most of these are exposed, in part, in the quadrangle (Gilluly, 1932; Tooker and Roberts, 1970, 1988b). The main stratigraphic ore horizons at Bingham include the Butterfield Peaks Formation and Clipper Ridge Member of the Bingham Mine Formation. At Ophir, the ore horizons are associated with those formations below the Oquirrh Group—the Great Blue Limestone, Humbug Formation, Deseret Limestone, Gardison Limestone, and the Ophir Formation (which does not crop out in the Lowe Peak quadrangle).

Brief lithologic descriptions of map units in the Lowe Peak quadrangle include those for unconsolidated and consolidated sedimentary rocks and intrusive and extrusive igneous rocks ranging in age from Cambrian to Holocene. More detailed descriptions can be found in the cited references.

Qod Mine waste dump materials (Holocene)

Ql Landslide debris (Holocene)

Qt Talus deposits (Holocene and Pleistocene)

Qa Alluvium (Holocene and Pleistocene)—Undifferentiated, unconsolidated alluvial fan and stream gravel, sand, silt, and boulder deposits within and bordering the mountain range. Thickness of stream and fan deposits is variable and estimated to range from less than 0.3 m at distal edges to more than 10 m locally in the upper parts. The fans may lie disconformably on Harkers Alluvium, where present.

Qh Harkers Alluvium (Pleistocene)—Undifferentiated, partly dissected, unconsolidated, thick, coarse fanglomerate deposits found locally near the mouth of West Canyon and Left Fork West Canyon. These deposits unconformably overlie Paleozoic rocks and are probably early Pleistocene as they are notched by the Lake Bonneville shoreline elsewhere in the range (Tooker and Roberts, 1992b). The poorly sorted, angular to rounded boulders, coarse to fine gravel, sand, silt, and mud were described by Slentz, 1955 and Tooker and Roberts, (1970). The unit's thickness in the quadrangle is unknown; it is as much as 31 m thick in the Ophir and Mercur quadrangles (Tooker, 1987).. No fossils have been found.

Oquirrh Group (Pennsylvanian)—Originally named the Oquirrh Formation by Gilluly (1932) but not subdivided into members; the Oquirrh Group, named by Welsh and James (1961) and its formational units described by Tooker and Roberts (1970), includes the Clipper Ridge Member of the Bingham Mine Formation, the Butterfield Peaks Formation, and West Canyon Limestone. The Bingham nappe sedimentary rocks in the Lowe Peak quadrangle include the lower parts of the group in the type localities (Tooker and Roberts, 1970). The basal Midas thrust on which the Bingham nappe moved is not exposed in the quadrangle, but several of the imbricate upper thrusts do occur here; however, the amount of movement on them has not been large.

ℙobc Clipper Ridge Member, Bingham Mine Formation (Upper Pennsylvanian)—The member, which was measured by Tooker and Roberts (1970), crops out in the northern part of the quadrangle. It is composed mostly of interbedded thick orthoquartzite, calcareous quartzite, calcareous and quartzose sandstone, and mostly thinner limestone layers as much as 30 m thick. However, a thicker basal marker bed (not shown), the Jordan limestone, is nearly 91 m thick where it crosses Middle Canyon just off the north border of the map. Quartzites commonly are medium to thick bedded, fine to medium grained, and locally crossbedded. The limestones are thin to medium bedded and consist of cherty, arenaceous, and argillaceous limestones and shale. Megafossils are sparse and poorly preserved; fusulinids are the most useful for dating these rocks. Gordon and Duncan (1970) considered them to be Missourian (upper Pennsylvanian). The member conformably overlies the Butterfield Peaks Formation.

IPobp Butterfield Peaks Formation (Middle Pennsylvanian)—Cyclically interlayered, thin- to medium-bedded, locally cross-bedded calcareous quartzite; tan to grayish-brown orthoquartzite and calcareous sandstones; medium-gray limestone and fossiliferous limestone; and olive-gray, brown-gray, and dark-gray arenaceous cherty, and argillaceous limestone. Limestones predominate over quartzites. The formation is 2,7065 m thick where measured at the head of West Canyon, and it crops out extensively in the Lowe Peak quadrangle. The Butterfield Peaks Formation conformably overlies the West Canyon Limestone and contains an abundant brachiopod, bryozoan, coral, and fusulinid fauna, which were considered Des Moinsean (Gordon and Duncan,1970).

IPow West Canyon Limestone (Lower Pennsylvanian)—The formation is 438 m thick in the type section in West Canyon (Nygreen, 1958; Tooker and Roberts, 1970). The rocks are cyclical clastic arenaceous limestones, composed of quartz and calcite grains and fossil fragments, with interbedded thin chert, argillaceous, and dense crystalline limestone beds. Thin calcareous quartzite and calcareous sandstone, generally banded or cross bedded, separate thicker limestones.and thicken upward in the formation. The lower contact with the Manning Canyon Shale is conformable. Megafossils are locally abundant. A Morrowan age was suggested (Gordon and Duncan, 1970).

IPMm Manning Canyon Shale (Lower Pennsylvanian and Upper Mississippian)—The formation is 350 m thick in the type section in Soldier Creek in the adjoining Stockton quadrangle (Tooker and Roberts, 1970). The rocks are composed of interbedded cyclical clastic calcareous shale and fossiliferous, argillaceous, and thin-bedded crystalline limestone. A prominent 1.2 m ledge-forming brown-weathering, crossbedded, and banded quartzite caps the lower one third of the formation. The lower part of the section is also conformable, grading from the limestone and lesser shale units of the underlying Great Blue Limestone into predominantly dark-gray carbonaceous shales and thin-bedded gray limestone of the Manning Canyon Limestone. Contact with the overlying Oquirrh Group is conformable and represents a transition from shale into clastic limestone of the West Canyon Limestone. The Mississippian-Pennsylvanian boundary is within in the upper part of the formation (Gordon and Duncan, 1970). Carbonate beds contain abundant bryozoans, brachiopods, and corals.

Great Blue Limestone (Upper Mississippian)—Gilluly (1932) subdivided the formation into three parts, an upper limestone member, the Long Trail Shale Member, and a lower limestone member. The formation is present mainly in the West Canyon drainage in the core of the Long Ridge anticline and in the Ophir mining district in the southwest corner of the quadrangle.

Mgu Upper limestone member—The member is 470 m thick and consists of alternating dark-gray, fossiliferous, sandy, and cherty limestone intervals and intervening shale and shaly limestone. The lower part is composed predominantly of interbedded light brownish-gray and tan, thin-bedded, banded, silty, and argillaceous limestones. These beds grade upward into interbedded medium- to dark-gray silty and argillaceous limestone, calcareous shale, and sandy limestone. Megafossil corals characterize the member, and were considered Chesterian (Tooker and Gordon, 1978). The member is conformable with the Long Trail Shale Member.

Mglt Long Trail Shale Member—The member is about 33 m thick (Tooker and Gordon, 1978) and conformable with the underlying lower limestone member. The member consists predominantly of interbedded dark-gray to black, calcareous and carbonaceous shales with interbedded thin-bedded, gray, fossiliferous and argillaceous limestone, and brownish gray silty limestone. The base of the Long Trail Shale Member represents an abrupt transition into the brown-weathering, lower limestone member.

Mgl Lower limestone member—The member is 260 m thick and conformable with the underlying Humbug Formation although the contact is transitional. The upper part of the member is interbedded dark-gray, brown weathering, thin- to medium-bedded, color banded, sandy, siliceous, cherty, argillaceous, and locally fossiliferous limestones. The mineralized horizon, locally called the Mercur mine series, which hosts the disseminated gold in the Mercur mining district includes the upper 73 m of the lower member (Kornze and others, 1984). At Mercur, the Mercur mine series includes a jasperoid bed at the base overlain by calcareous sandstone, fossiliferous limestone, and argillaceous limestone, and it becomes more argillaceous near the top as it grades into the Long Trail Shale. The basal unit of the lower limestone member characteristically is composed of massive cliff-forming, medium- to thick-bedded, blue-gray limestones and interbedded argillaceous limestones and calcareous sandstones, which is correlated with the Topliff member of the Great Blue Formation at Tintic, Utah (Morris and Lovering, 1961). Locally the lower limestone member is fossiliferous and contains brachiopods, bryozoans, and corals. The upper part of a Meramecian-age coral zone is present in the lower part of the member (Tooker and Gordon, 1978).

Mh Humbug Formation (Upper Mississippian)—The formation is about 198 m thick and conformable with the underlying Deseret Formation. Its limited exposures in the quadrangle are in fault-separated blocks in the Ophir mining district. It is a ledge-and-slope unit characterized by alternating brown-weathering quartz sandstone or quartzite and medium-gray limestone. Fossils include brachiopods, corals, and bryozans (Gilluly, 1932).

Md Deseret Limestone (Upper Mississippian)—The formation is about 200 m thick, is conformable with the underlying Gardison Limestone, and is exposed in this quadrangle only in the Ophir mining district. It is mainly a massive, blue-gray, fine-grained to sandy limestone containing black chert nodules. A basal marker bed of black shale, which contains a thin bed of phosphatic oolites at its top, separates the Deseret Limestone from the underlying lithologically similar Gardison Limestone (Gilluly, 1932) Fossils include brachiopods, bryozoans, and corals.

Mg Gardison Limestone (Lower Mississippian)—The formation is about 140 m thick on the west side of Ophir Canyon. It conformably overlies Fitchville Formation and Pinyon Peak Limestone, Undivided, without angular discordance, but along an erosional surface, or, according to Gilluly (1932), a karst topography. The Gardison Limestone is a thin- and medium-bedded, bluish gray, dense, cherty limestone. The unit contains an abundant coral, brachiopod, and gastropod fauna (Gilluly,1932).

MDfp Fitchville Formation (lower Mississippian and Upper Devonian) **and Pinyon Peak Limestone** (Upper Devonian). **Undivided**—The 56 m thick sequence unconformably overlies the Lynch Dolomite in the Ophir mining district. The upper massive, white, siliceous limestone, medium-gray crystalline dolomite, and lower dark-gray, coarse-grained, massive ,black-weathering dolomite, which contains large oval calcite blebs (locally called the "eye" bed), are presumed correlative with the lower half of the Fitchville Formation at Tintic , Utah (Morris and Lovering, 1961), which contains both limestones and dolomite. Corals are sparse. The lower 8 m of the formational unit is a poorly exposed fine grained, soft, shaly and dolomitic sandstone that weathers reddish to brownish and is overlain by white siliceous limestone. These rocks are correlative with part of the Pinyon Peak Limestone (Gilluly, 1932; Morris and Lovering, 1961). The contact between the Pinyon Peak and Fitchville strata apparently is conformable here, as at Tintic. The lower contact with the underlying Lynch Dolomite is conformable.

Ꞓl Lynch Dolomite (Middle? and Upper Cambrian)—The formation is a thick sequence of dominantly massive gray dolomite and is well exposed in; Ophir Canyon. Lower beds apparently are conformable with the underlying Bowman Limestone. Only the uppermost part of the formation crops out in the quadrangle. Fossils are rare (Gilluly, 1932).

Igneous rocks

Intrusive porphyritic quartz monzonitic and related rocks (Ti), which are centered on the Bingham and Last Chance stocks at Bingham, cross the northern part of the quadrangle as discontinuous plugs, dikes, and sills. Volcanic rocks (Tv) in the northeastern part of the quadrangle include mainly latitic flows, breccia flows, and latitic-rich lahar flows. Neither the intrusive nor volcanic rocks have been subdivided here; the unit subdivisions, however, can be seen in the maps compiled by A.J. Swensen (1975) and by W.J. Moore (1973a).

Tv Extrusive rocks (Oligocene)—Undifferentiated latite and andesite flows, breccia flows, and laharic breccias composed of fragments from variable volcanic lithology crop out along the northeast border of the quadrangle as westward extensions from the

Tickville Springs quadrangle (Moore, 1973a, 1973b; Smith, 1961, and Swensen, 1975). The age of volcanic rocks is generally regarded as 30.7-31.2 Ma, younger than the intrusions (Moore 1973a).

Ti Intrusive rocks (Oligocene)—Undifferentiated quartz monzonite, quartz monzonite porphyry, quartz latite, and latite porphyry plugs, dikes, and sills (Gilluly, 1932; Bray, 1969; Moore,1973a; and Swensen,1975). They occur in a prominent sequence of dikes and plugs that extends across the northwest corner of the quadrangle between the Bingham and Stockton intrusive centers, both of which lie immediately outside of the Lowe Peak quadrangle. The age of the quartz latite porphyry dike in Middle Canyon is 37.1 Ma (Moore, 1973a). The cluster of sills and dikes immediately south of the Bingham mine in the northeast corner of the quadrangle include monzonite, quartz monzonite, and latite porphyry (Swensen, 1975).

Ore deposits

The base- and precious-metal vein and replacement deposits in the quadrangle include those in the northeast edge of the Ophir mining district and the southern part of the Bingham mining district north of Butterfield Creek. Several small mines and prospects are located in West Canyon. The vein and replacement deposits in the Bingham mining district have been described by Rubright and Hart (1968), and those in the Ophir district by Gilluly (1932) . The Mayflower mine at the head of West Canyon is considered a part of the Bingham (or West Mountain) district (Gilluly, 1932) but has no record or production of base metals. A prospect at the mouth of the Left Fork West Canyon has been explored for disseminated gold in the upper part of the lower member of the Great Blue Limestone; this is the same stratigraphic horizon in which the gold is found at Mercur. The grade in this West Canyon prospect is too low to mine at present (Klatt, H.R., oral commun., 1991).

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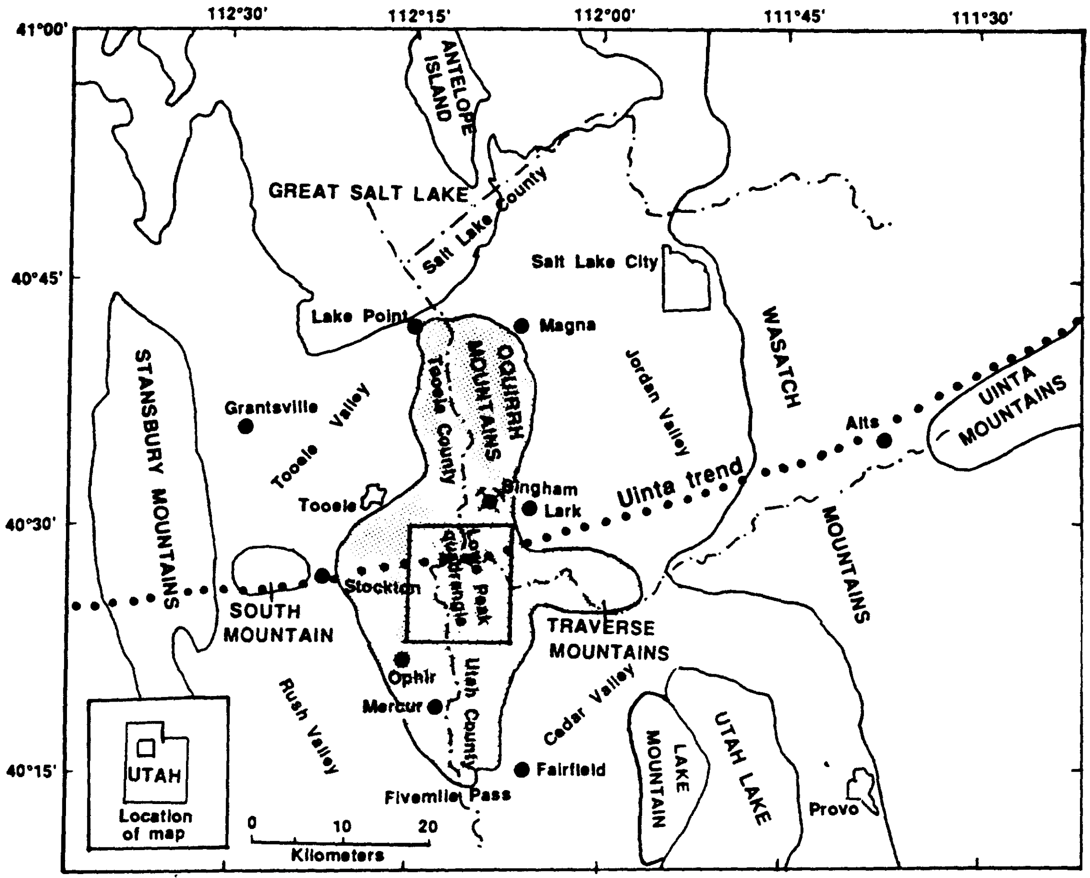

Figure 1. Location of the Lowe Peak quadrangle in the Oquirrh Mountains