Oak City
51-1

# SURFICIAL GEOLOGY OF THE OAK CITY AREA
# MILLARD COUNTY, UTAH

By

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The Oak City area in the northeast corner of Millard County, Utah (see index map), includes part of the eastern shore of ancient Lake Bonneville, which covered much of western Utah during the Pleistocene epoch. The eastern part of the mapped area is occupied by the western slope of the Canyon Range; the central and western parts are a lowland covered by gently southwestward sloping sediments that were deposited in Lake Bonneville, and by fluvial and eolian deposits. The accompanying geologic map is, in general, confined to the basin occupied by the Quaternary deposits.

Most of the lowland area is the surface of a large, nearly flat delta built southwestward into ancient Lake Bonneville by the Sevier River as it left the mountain front near the present site of Leamington (sec. 10, T. 15 S., R. 4 W.). Between the eastern edge of the delta and the Canyon Range are broad aprons of alluvial deposits laid down by streams issuing from the mountains. The largest part of the alluvial material (Qf$_1$) was deposited before the highest stage of the lake was attained. A few small fans (Qf$_2$) and large thin sheets of silt (Qsi$_2$) represent the post-lake deposition.

The evidence contained in deposits examined in this area indicates that the lake rose gradually with minor fluctuations to its highest or Bonneville level (alt. approx. 5100), during which time the Alpine and Bonneville formations were deposited. Except for near-shore gravel beaches, these formations are composed largely of clay, silt, and fine sand. The coarser materials were deposited in an arm of the lake extending farther up the Sevier River Valley. Shortly after attaining the Bonneville level the lake found an outlet elsewhere and dropped rapidly to a low but unknown elevation. The delta was incised in its upper part, and the Provo gravel (Qpsg) was deposited in a broad stream channel following about the same course as the present Sevier River. The lake rose again to an altitude of about 4820 feet, and Provo silt and sand (Qpsi and Qps) were deposited over the gravel and on the delta surface.

As the lakedropped during the final stages of desiccation, the Sevier River cut the present steep-walled valley 50 to 150 feetdeep through the Provo gravels and into the older lake silts and clays. The area is now being actively eroded by wind, and a large part of the delta is covered by dune sand which obscures the relations of the underlying lacustrine and fluvial deposits.

The Oak City area lies in a generally active seismic region. Although no evidence of recent faulting was noted in the area the Bonneville beach has been warped out of level, and ranges from 5090 to 5150 feet in altitude. Christiansen reports recent faulting near the eastern base of the Canyon Range.

All text and map information pertaining to the consolidated Tertiary and older rocks of the Canyon Range was kindly furnished by Dr. Francis W. Christiansen of the University of Utah from his unpublished manuscripts.

## DESCRIPTION OF MAP UNITS

### Unconsolidated materials

| MAP UNIT | LITHOLOGY | TOPOGRAPHIC FORM | DRAINAGE AND PERMEABILITY | RESISTANCE TO EROSION | SLOPE STABILITY EASE OF EXCAVATION | OBSERVED USE |
|---|---|---|---|---|---|---|
| Qgp | Gypsite. Playa deposit of silt and clay containing much gypsum in the upper 1 foot, grades downward into normal silt and clay; light gray, semiconsolidated. Occurs only in the extreme southeast corner of the mapped area. | Smooth, undissected surface broken by a few low dunes of quartz sand and gypsum. | Drainage poor, permeability moderate to low. Subject to high water table or flooding during maximum irrigation of nearby farmlands. | Susceptible to erosion by wind and water. | No slopes observed. Easily excavated. | None |
| Qs | Fine- to medium-grained sand in active and stabilized dunes composed predominantly of rounded quartz grains 0.1 to 0.6 mm. in diameter. Light tan, except in southwest part of mapped area where many dunes are composed of dark gray basaltic sand. Maximum thickness about 40 feet. | Stabilized dunes have irregular hummocky surface. Active dunes have crescent shapes and leave long low ridges behind as they move forward. Maximum height of dunes about 40 ft. | No surface drainage. Very permeable. | Erosion by water negligible except where dunes cross established streams or irrigation ditches. Active wind erosion; some dues move about 10 feet per year SW to NE. | Slopes unstable above angle of repose of dry sand. Easily excavated by hand or power tools. | Grazing land. |
| Qsg | Predominantly sand with minor amount of pebbles: unconsolidated. Forms a persistant mantle, generally only a few feet thick, over a large area west of Oak City. It is probably partly derived from the underlying lake sediments. Many stabilized, and some active, sand dunes are included within this unit. | Surface hummocky due to sand dunes 2 to 40 feet high. General slope of surface is gently southwest. | Well-drained without visible surface runoff. Very permeable but overlies less permeable Qbsi, Qpsi. | High permeability prevents much erosion by small streams from the mountains. Finest material is actively eroded and transported by wind. | Slopes unstable above angle of repose of dry sand (about 31°). Easily excavated by hand or power tools. | Grazing land. |
| Qsi$_2$ | Predominantly silt with local lenses of sand and gravel; tan to gray, unconsolidated, 5 to 15 feet thick. Occurs extensively on flood-plain of the Sevier River, mantles lake sediments on the high bluffs near Leamington, and extends southeast of Leamington along the mountain front. May be in part deposited by wind. | Flood plain of Sevier River is smooth to moderately irregular due to meander scarps. High silt-covered bench north and south of flood plain near Leamington is deeply dissected near bluffs. | Well-drained, porous, and permeable along mountain front. Along Sevier River runoff is heavy and material less permeable due to higher proportion of clay. | Highly susceptible to erosion. | Unstable except on low slopes. Easily excavated by hand or power tools. | Farm and grazing land. Locally used for binder in gravel roads. |
| Qf$_2$ | Alluvial fan and stream channel deposits. Composed of boulders, cobbles, pebbles, sand, silt, and clay; poorly sorted, unconsolidated to semiconsolidated. Occur along the western base of the Canyon Range. Coarser fractions are more abundant and angular close to the mountains, less abundant and subrounded basinward. Contact with Qsi$_2$ is gradational. | Cone-shaped alluvial fans have moderate slopes near mountain front, becoming flatter to the west. Cut by numerous small gullies. Channel deposits have even, moderate grade and are confined by steep banks 2 to 10 feet high. | Well-drained by surface runoff in gullies. Nearly impermeable to permeable depending on the highly variable amount of silt and clay present. | Moderately resistant to erosion. | Slopes fairly stable. Near the mountain front this unit contains rocks of size requiring removal by bulldozer or power shovel. | Grazing land. |
| Qpsi | Silt; tan, semiconsolidated, generally less than 10 feet thick. Occurs mainly in the west central part of the mapped area. | Generally smooth and undissected surface except along bluffs above the Sevier River. | Some surface drainage. Moderately permeable due to some intercalated sand beds. | Susceptible to erosion by wind and running water. | Capable of standing in steep banks when dry, but slumps when wet. | Farm and grazing land. |
| Qps | Silty sand; fine-grained, light tan, unconsolidated to semiconsolidated, generally less than 10 feet thick. Occurs mainly in the western part of the mapped area as filling in old stream channels formed before the cutting of the present Sevier River Valley. | Generally smooth and undissected surface. Commonly hummocky where subject to wind erosion. | Little or no surface drainage. Permeable. | Susceptible to erosion by wind and running water. | Slopes fairly stable unless wet. | Grazing land. |
| Qpsg | Sand and gravel; unconsolidated, pebbles are mostly quartzite and limestone with considerable amounts of volcanic rocks and chert. Thickness is variable, averaging about 10 feet, maximum about 40 feet. Crops out along the top of the bluffs along the Sevier River in the west and north central parts of the mapped area, and on low hills within the Sevier River Valley east of Leamington. | Low to moderate slopes; generally forms break in slope near top of steep river bluffs. | Well-drained. Very permeable. | Moderatly resistant to erosion. | Slopes unstable above angle of repose of gravel. Easily excavated by hand or power tools. | Source of sand and gravel (see G-1 to G-8, G-14). |
| Qbs | Sand; fine-grained, well-sorted, unconsolidated, composed predominantly of quartz grains, commonly less than 15 feet thick. Occurs northeast and east of Leamington. | Generally moderately steep slopes, partly dissected. | Well-drained. Permeable. | Susceptible to erosion by wind and runing water. | Unstable above angle of repose of dry sand. Easily excavated. | Grazing land. |
| Qbsg | Sand with some pebbles; poorly consolidated. Occurs near the Bonneville shore line along the front of the Canyon Range. | Partly dissected embankments and spits built by waves and longshore currents of Lake Bonneville. | Well-drained. Permeable. | Susceptible to erosion by wind and runing water. | Unstable above angle of repose of gravelly sand. Easily excavated. | Source of sand and gravel (see G-9). |
| Qbg | Sand and gravel; well-sorted within any single layer, rounded, semiconsolidated, pebbles composed almost entirely of quartzite and limestone. Occurs close to the Bonneville shore line along the front of the mountains. Southern deposits contain bed of black volcanic cinders 1 to 6 inches thick. | Little dissected embankments and long, narrow bars and spits built by waves and longshore currents of Lake Bonneville. | Well-drained. Very Permeable. | Resistant to erosion except by strong streams. | Unstable above angle of repose of coarse gravel. Easily excavated by light power tools. | Source of sand and gravel (see G-10 to G-13). |
| Qbr | Beach rubble. Consists of large angular blocks of conglomerate up to 20 feet long, in a matrix of boulders, cobbles, pebbles, sand, and silt; poorly sorted and poorly consolidated. Derived from Tf. Present only along the Bonneville shore line bench cut into a ridge of Tf projecting westward from the mountain front 5 miles north of Oak City. | Moderately sloping, partly dissected embankment. | Well-drained. Moderately permeable. | Resistant to erosion except the removal of fines by rainwater. | Stable on moderate slopes. Large blocks of rock will require removal by blasting and heavy power tools. | Grazing land. |
| Qbsi | Silt and clay. Thick and thin beds of clay interbedded with beds of massive silt and ripple-marked sand; tan- to light-gray, semiconsolidated, 40 to 200 feet thick. Upper part is predominantly silt and sand, and lower part predominantly blocky clay in western part of area. The grain size increases progressively toward the head of the delta, and the beds become lenticular. Ostracods are common throughout the unit, and gastropods are abundant in the upper sandy parts. Near the eastern margin of the basin the uppermost part of the unit locally contains a 1 to 5 foot thick bed of white diatomaceous marl and a thin layer of black volcanic ash. The Qbsi map unit underlies a large part of the mapped area, and is well-exposed along the bluffs of the Sevier River Valley. | Generally smooth undissected surface. Near the Sevier River this unit forms steep to vertical cliffs. | Some surface drainage. Lower clayey part is impermeable except along joints. Upper silty and sandy part is moderately permeable. | Easily eroded by running water. | Steep cuts stand well when dry but slump after prolonged wetting. Lower blocky clay maintains steep to vertical faces by breaking along vertical joints if undercut. Upper sandy and silty part is easily excavated by hand; lower clay may require light power tools. | Farm and grazing land. |
| Qsi$_1$ | Sandy silt: mottled brown-orange and tan, semiconsolidated. Occurs on the high bluffs southeast of Leamington. Partly covered by Lake Bonneville sediments and is probably equivalent in age to Qf$_1$. | Generally smooth, gently sloping, undissected surface. Dissected into steep slopes near bluffs of the Sevier River. | Well-drained by surface runoff. Moderately permeable. | Susceptible to erosion by running water. | Slopes stable unless thoroughly wetted. Some parts of unit are sufficiently consolidated to require power tools for excavation. | Farm and grazing land. |
| Qf$_1$ | Alluvial fans similar to Qf$_2$ in composition, but of an older age and distinguished from Qf$_2$ by being partly covered with lake deposits or notched by wave-cut terraces formed at the Bonneville stage of the lake, and by generally containing a caliche zone near the top of the deposit. | Cone-shaped deposits, some coalesced into broad aprons sloping away from the mountain front. | Well-drained by many small gullies. Permeable to impermeable depending on the variable amount of silt and clay present. | Moderately resistant to erosion except by swiftly moving water. | Slopes fairly stable. Near the mountain front the unit contains rocks of size requiring removal by bulldozer or power shovel. | Grazing and farm land. Source of groundwater in wells west of the front of the mountains. |

### Consolidated Tertiary and older rocks

| | | | | | | |
|---|---|---|---|---|---|---|
| Tf | Fool Creek conglomerate. Light colored, commonly mottled pale-yellow, orange-pink, and pale-purple. Composed chiefly of poorly-sorted, subangular to rounded, limestone and limestone conglomerate fragments from 1 inch to several feet in diameter, moderately well cemented in a matrix of calcareous sand and silt. Thickness is 1,800 feet. | Forms steep-sided ridges with rounded crests, deeply dissected, projecting westward from the mountain front. | Well-drained by surface runoff. Moderately permeable to impermeable. | Resistant to erosion. | Natural grass-covered slopes of at least 30° are stable. Excavation requires power equipment. | Grazing land. |
| Kpi | Price River (?) and Indianola group. Thick series of gray to red, fine to coarse, terrestrial conglomerates that grade upward into interbedded gray- to light-brown sandstone and shale with a few lentils of limestone. Thickness is 12,500 feet. | Steeply sloping, well-dissected, mountainous terrain. | Well-drained, runoff large. Moderately permeable to impermeable. | Resistant to erosion. | Stable on steep to vertical slopes. Excavation requires blasting and power equipment. | Grazing land. |
| €O1 | Undifferentiated Upper Cambrian and Ordovician limestone and dolomite, 4,750 feet thick. Dense, hard, massive-to thin-bedded, light-gray to dark-gray, limestone and dolomite. Lithology is similar to Upper Cambrian and Ordovician rocks of the Tintic Mining District. | Steeply sloping, well-dissected, mountainous terrain. | Well-drained, probably contains permeable channels and zones. | Resistant to erosion. | Stable on steep to vertical slopes. Excavation requires blasting and power tools. | Grazing land. |
| €o | Ophir formation, 975 feet thick. Lower part is olive-green to light-brown micaceous shale with worm-like markings on bedding planes: 30 feet thick, dark-red to black, glauconitic, persistent ridge-making quartzite at top of the shale. Upper part is interbedded shale and light-brown to light-gray mottled limestone. | Steeply sloping, well-dissected, mountainous terrain. | Well-drained, mostly impermeable. | Resistance to erosion varies with lithology. Quartzite at top is very resistant, shale below is moderately resistant. | Varies with lithology. | Grazing land. Limestone quarry operated by sugar refinery is located south of Sevier River just off northeast corner of mapped area. |
| €t | Tintic quartzite, 1,500 feet thick. Light-colored, pink- to light-gray, evenly bedded and thinly bedded micaceous quartzite. Lower part is conglomeratic. | Steeply sloping, well-dissected, mountainous terrain. | Well-drained by surface runoff. Impermeable. | Very resistant to erosion. | Stable on steep to vertical slopes. Excavation requires blasting and power tools. | Grazing land. Has been quarried on small scale for use in production of refractory brick. |
| p€ | Undifferentiated pre-Cambrian rocks of Proterozoic(?) age. Thick series of alternating units of red- to light olive-green shale and massive red- to pale-purple quartzite and conglomerate: light-gray, oolitic and styolitic limestone beds in lower part: basal beds of section are in thrust fault contact with younger rocks. | Steeply sloping, well-dissected, mountainous terrain. | Well-drained by surface runoff. Impermeable. | Very resistant to erosion. | Stable on steep to vertical slopes. Excavation requires blasting and power tools. | Grazing land. |

## MATERIALS TEST DATA

| | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FRACTION OF ¼ SECTION | | | SW | NE | SW | SW | NE | SE | SW | NW | SE | SE | NE | NE | SE | SE | SE | SW | NE | NE | NW |
| ¼ SECTION | | | NE | SW | NE | SE | NW | SW | SE | NE | SW | NE | SE | SW | NW | SW | SW | NE | SE | SE | NE |
| SECTION | | | 2 | 34 | 15 | 12 | 12 | 11 | 9 | 18 | 6 | 23 | 5 | 32 | 33 | 4 | 32 | 12 | 23 | 2 | 2 |
| TOWNSHIP | | | 15 | 17 | 17 | 15 | 15 | 15 | 15 | 15 | 15 | 15 | 16 | 16 | 15 | 16 | 16 | 17 | 17 | 18 | 15 |
| RANGE | | | 4 | 5 | 5 | 4 | 4 | 4 | 4 | 4 | 4 | 5 | 5 | 6 | 5 | 4 | 4 | 5 | 5 | 5 | 4 |
| GEOLOGIC FORMATION | | | Qf$_1$ | Qf$_1$ | Qf$_2$ | Qf$_2$ | Qpsg | Qpsg | Qpsg | Qpsg | Qpsg | Qpsg | Qpsg | Qpsg | Qpsg | Qbsg | Qbg | Qbg | Qbg | Qbg | Qbg |
| MECHANICAL ANALYSIS (Percent Passing) | Sieve | 3" | 88 | 65 | 87 | 100 | 100 | 100 | | | 100 | | | | | | 100 | 100 | 100 | 100 | 95 |
| | | 1½" | 45 | 40 | 70 | 73 | 95 | 99 | 100 | 100 | 98 | 100 | 100 | 100 | 100 | 100 | 93 | 86 | 99 | 97 | 91 |
| | | 3/4" | 28 | 26 | 57 | 54 | 80 | 88 | 95 | 88 | 85 | 89 | 95 | 92 | 97 | 99 | 78 | 67 | 85 | 88 | 73 |
| | | 3/8" | 20 | 19 | 43 | 47 | 59 | 70 | 79 | 79 | 66 | 62 | 74 | 71 | 78 | 90 | 58 | 52 | 66 | 60 | 34 |
| | U.S. Standard | # 4 | 15 | 15 | 33 | 40 | 46 | 54 | 62 | 65 | 49 | 43 | 55 | 52 | 59 | 72 | 43 | 39 | 44 | 40 | 19 |
| | | # 10 | 12 | 14 | 27 | 33 | 37 | 44 | 45 | 54 | 39 | 29 | 42 | 38 | 46 | 51 | 25 | 29 | 28 | 18 | 16 |
| | | # 18 | 10 | 13 | 25 | 29 | 31 | 38 | 33 | 47 | 34 | 22 | 36 | 29 | 40 | 36 | 15 | 20 | 20 | 11 | 16 |
| | | # 30 | 9 | 13 | 24 | 27 | 25 | 30 | 24 | 42 | 29 | 18 | 31 | 23 | 34 | 25 | 9 | 14 | 17 | 7 | 15 |
| | | # 40 | 9 | 12 | 23 | 26 | 21 | 21 | 16 | 35 | 24 | 13 | 25 | 17 | 28 | 18 | 5 | 10 | 15 | 5 | 15 |
| | | # 60 | 8 | 10 | 20 | 23 | 13 | 6 | 5 | 18 | 11 | 6 | 9 | 7 | 7 | 4 | 2 | 6 | 7 | 3 | 13 |
| | | #100 | 7 | 6 | 13 | 20 | 7 | 2 | 2 | 6 | 4 | 3 | 4 | 3 | 2 | 2 | 1 | 4 | 2 | 1 | 7 |
| | | #200 | 5 | 3 | 5 | 15 | 5 | 1 | 1 | 2 | 1 | 1 | 2 | 1 | 1 | 1 | 0 | 2 | 1 | 1 | 2 |
| | Hydrometer | 0.0500mm | | | | | | | | | | | | | | | | | | | |
| | | 0.0370mm | | | | | | | | | | | | | | | | | | | |
| | | 0.0190mm | | | | | | | | | | | | | | | | | | | |
| | | 0.0090mm | | | | | | | | | | | | | | | | | | | |
| | | 0.0050mm | | | | | | | | | | | | | | | | | | | |
| | | 0.0036mm | | | | | | | | | | | | | | | | | | | |
| | | 0.0010mm | | | | | | | | | | | | | | | | | | | |
| LOS ANGELES, GRADE A-12, PERCENT LOSS | | | | | | | 25 | 24 | 23 | 24 | 24 | 24 | 22 | 22 | 22* | 24 | 18 | 26 | 22 | 23 | |
| LIQUID LIMIT | | | | | | | | | | | | | | | | | | | | | |
| PLASTIC LIMIT | | | | | | | | | | | | | | | | | | | | | |
| PLASTIC INDEX | | | | | | | | | | | | | | | | | | | | | |
| PEBBLE COUNT (Percent) | | Limestone | 0 | 16 | 17 | 35 | 40 | 27 | 29 | 23 | 44 | 50 | 22 | 35 | 19 | 7 | 2 | 25 | 9 | 18 | 74 |
| | | Quartzite | 100 | 84 | 83 | 65 | 35 | 43 | 37 | 37 | 37 | 23 | 39 | 22 | 19 | 92 | 98 | 69 | 91 | 81 | 26 |
| | | Volcanic | 0 | 0 | 0 | 0 | 16 | 16 | 17 | 21 | 11 | 19 | 24 | 26 | 29 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | Chert | 0 | 0 | 0 | 0 | 9 | 14 | 18 | 19 | 7 | 9 | 14 | 17 | 34 | 1 | 0 | 6 | 1 | 1 | 0 |

| | | | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | D 40$_2$ | D 40$_3$ | R 14 | R 23 | R 25 | R 32 | R 34 | R 48 | D 49$_1$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FRACTION OF ¼ SECTION | | | SW | SW | SW | NE | NE | NE | SW | SE | SW | SW | NW | NW | SW | SW | SE | NE | NE | NE | SE |
| ¼ SECTION | | | NE | NE | NE | SE | SE | NE | NE | NW | NE | NE | SW | SW | NW | SW | NW | NE | NW | NW | SE |
| SECTION | | | 12 | 2 | 2 | 23 | 23 | 32 | 2 | 28 | 15 | 2 | 2 | 2 | 10 | 4 | 36 | 1 | 16 | 2 | 31 |
| TOWNSHIP | | | 15 | 15 | 15 | 17 | 17 | 15 | 17 | 16 | 17 | 15 | 18 | 18 | 16 | 16 | 15 | 15 | 16 | 17 | 17 |
| RANGE | | | 4 | 4 | 4 | 5 | 5 | 5 | 6 | 5 | 5 | 4 | 5 | 5 | 5 | 5 | 6 | 5 | 5 | 5 | 5 |
| GEOLOGIC FORMATION | | | Qbg | Qbg | Qbg | Qbg | Qbg | Qps | Qps | Qps | Qbs | Qbs | Qbs | Qbs | Qsg | Qs | Qs | Qs | Qs | Qs | Qsg |
| MECHANICAL ANALYSIS (Percent Passing) | Sieve | 3" | 100 | | | | 100 | | | | | | | | | | | | | | |
| | | 1½" | 56 | 100 | 100 | | 99 | | | | | | 100 | | | | | | | | |
| | | 3/4" | 20 | 92 | 90 | 100 | 87 | 100 | | 100 | | | 97 | | | | | | | | |
| | | 3/8" | 18 | 80 | 61 | 99 | 65 | 99 | | 99 | 100 | | 97 | | | | | | | | |
| | U.S. Standard | # 4 | 18 | 63 | 31 | 97 | 40 | 97 | | 96 | 99 | 100 | 97 | 100 | | 100 | | | | | |
| | | # 10 | 18 | 43 | 20 | 82 | 28 | 96 | | 93 | 98 | 99 | 97 | 99 | | 99 | | | | | |
| | | # 18 | 18 | 23 | 12 | 43 | 23 | 94 | 100 | 91 | 97 | 99 | 96 | 99 | | 96 | | | | | 100 |
| | | # 30 | 18 | 14 | 9 | 22 | 20 | 92 | 99 | 89 | 94 | 99 | 94 | 96 | 100 | 89 | 100 | 100 | 100 | 100 | 89 |
| | | # 40 | 18 | 11 | 7 | 12 | 18 | 90 | 99 | 86 | 91 | 98 | 94 | 85 | 99 | 78 | 99 | 98 | 99 | 99 | 67 |
| | | # 60 | 16 | 6 | 5 | 2 | 9 | 77 | 81 | 58 | 78 | 98 | 85 | 28 | 65 | 47 | 52 | 68 | 78 | 82 | 28 |
| | | #100 | 6 | 4 | 3 | 1 | 2 | 61 | 18 | 28 | 6 | 87 | 48 | 5 | 22 | 25 | 13 | 27 | 24 | 32 | 10 |
| | | #200 | 1 | 3 | 2 | 1 | 1 | 29 | 1 | 11 | 2 | 17 | 9 | 1 | 9 | 6 | 2 | 7 | 1 | 2 | 2 |
| | Hydrometer | 0.0500mm | | | | | | | | | | | | | | | | | | | |
| | | 0.0370mm | | | | | | | | | | | | | | | | | | | |
| | | 0.0190mm | | | | | | | | | | | | | | | | | | | |
| | | 0.0090mm | | | | | | | | | | | | | | | | | | | |
| | | 0.0050mm | | | | | | | | | | | | | | | | | | | |
| | | 0.0036mm | | | | | | | | | | | | | | | | | | | |
| | | 0.0010mm | | | | | | | | | | | | | | | | | | | |
| LOS ANGELES, GRADE A-12, PERCENT LOSS | | | | | | | | | | | | | | | | | | | | | |
| LIQUID LIMIT | | | | | | | | | | | | | | | | | | | | | |
| PLASTIC LIMIT | | | | | | | | | | | | | | | | | | | | | |
| PLASTIC INDEX | | | | | | | | | | | | | | | | | | | | | |
| PEBBLE COUNT (Percent) | | Limestone | 8 | 0 | 0 | 28 | 23 | | | | | | | | | | | | | | |
| | | Quartzite | 92 | 100 | 100 | 72 | 77 | | | | | | | | | | | | | | |
| | | Volcanic | 0 | 0 | 0 | 0 | 0 | | | | | | | | | | | | | | |
| | | Chert | 0 | 0 | 0 | 0 | 0 | | | | | | | | | | | | | | |

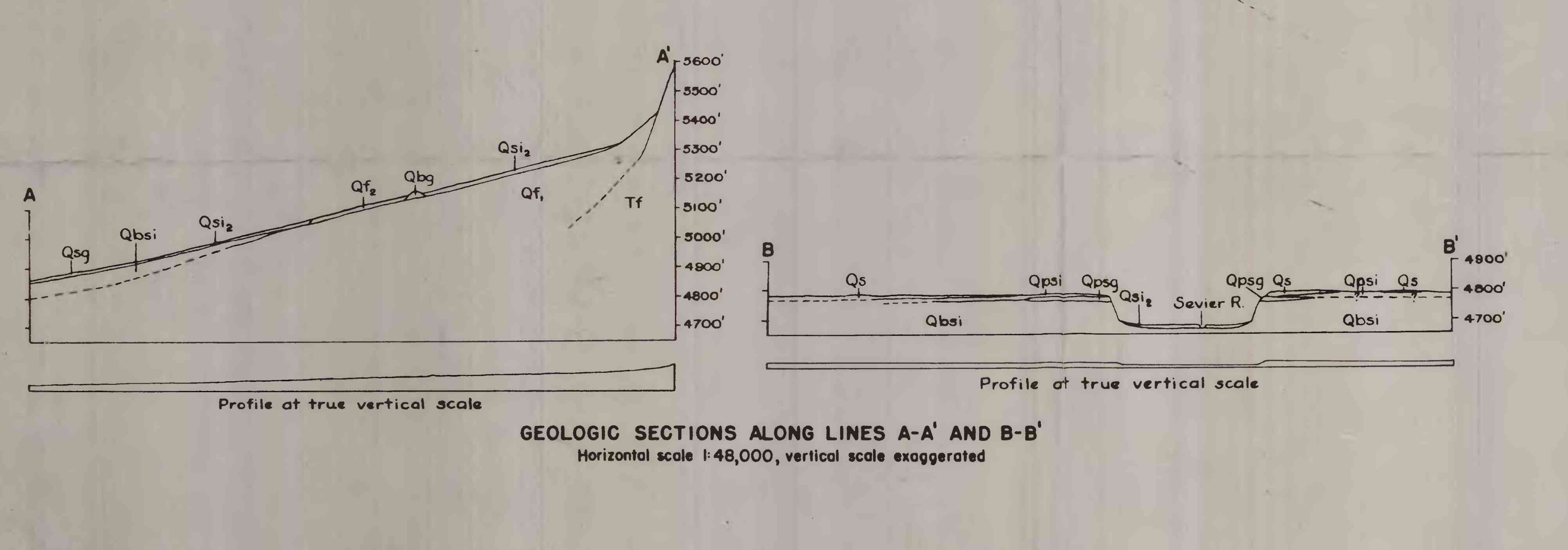
| | | | R30 | R 31 | R 35 | R 21 | R 38$_1$ | R 38$_2$ | D 41 | D 50 | D 56 | D 74 | D 85 | R 45 | R 24 | R 28 | R 33 | R 44 | R 47 | D 40$_1$ | D 84 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FRACTION OF ¼ SECTION | | | W | SW | SE | NW | SW | SW | NW | NE | SE | NE | SE | NW | NW | SW | SE | NE | NE | NW | NW |
| ¼ SECTION | | | W | NE | NW | SE | SE | SE | NE | SE | SW | SW | NE | NW | SW | NW | SE | SE | SW | SW | NW |
| SECTION | | | 3 | 3 | 8 | 12 | 7 | 7 | 4 | 30 | 18 | 6 | 4 | 13 | 19 | 26 | 32 | 23 | 12 | 2 | 35 |
| TOWNSHIP | | | 5 | 15 | 17 | 15 | 16 | 16 | 18 | 16 | 16 | 15 | 16 | 15 | 15 | 16 | 14 | 15 | 15 | 18 | 15 |
| RANGE | | | 5 | 5 | 5 | 5 | 4 | 4 | 5 | 4 | 5 | 4 | 4 | 4 | 4 | 6 | 4 | 5 | 4 | 5 | 4 |
| GEOLOGIC FORMATION | | | Qsi | Qpsi | Qpsi | Qbsi | Qbsi | Qbsi | Qbsi | Qbsi | Qbsi | Qbsi | Qbsi | Qsi$_1$ | Qsi$_2$ | Qsi$_2$ | Qsi$_2$ | Qsi$_2$ | Qsi$_2$ | Qsi$_2$ | Qsi$_2$ |
| MECHANICAL ANALYSIS (Percent Passing) | Sieve | 3" | | | | | | | | | | | | | | | | | | | |
| | | 1½" | | | | | | | | | | | | | | | | | | | |
| | | 3/4" | | | | | | | | | | | | | | | | | | | |
| | | 3/8" | | | | | | | | | | | | | | | | | 100 | 100 | |
| | U.S. Standard | # 4 | | | | | | | | | | | | | | | | | 99 | 97 | |
| | | # 10 | | | | | | | | | | | | | | | | | 99 | 97 | |
| | | # 18 | | | | | | | | | 100 | | | | | | | | 99 | 97 | |
| | | # 30 | | | 100 | | 100 | | 100 | | 99 | | | | | | | | 99 | 96 | |
| | | # 40 | 10 | 100 | 99 | | 98 | | 99 | | 98 | | 100 | | 100 | | | | 99 | 95 | 100 |
| | | # 60 | 7 | 96 | 94 | | 88 | | 98 | | 96 | | 99 | 100 | 99 | 100 | 100 | 100 | 98 | 91 | 99 |
| | | #100 | 4 | 88 | 86 | | 63 | 100 | 90 | 100 | 94 | | 98 | 98 | 97 | 97 | 97 | 99 | 88 | 68 | 96 |
| | | #200 | [illegible] | 78 | 76 | 100 | 47 | 99 | 59 | 90 | 91 | 100 | 90 | 90 | 84 | 73 | 83 | 93 | 42 | 28 | 85 |
| | Hydrometer | 0.0500mm | [illegible] | 60 | 62 | 98 | 39 | 85 | 46 | 67 | 80 | 92 | 81 | 79 | 79 | 52 | 62 | 72 | 35 | 26 | 66 |
| | | 0.0370mm | [illegible] | 58 | 57 | 97 | 33 | 81 | 38 | 53 | 74 | 91 | 67 | 63 | 65 | 40 | 46 | 60 | 25 | 20 | 54 |
| | | 0.0190mm | [illegible] | 50 | 50 | 94 | 24 | 65 | 36 | 34 | 66 | 86 | 9 | 41 | 13 | 30 | 30 | 35 | 14 | 12 | 36 |
| | | 0.0090mm | [illegible] | 43 | 40 | 85 | 21 | 48 | 9 | 25 | 28 | 74 | 3 | 25 | 13 | 22 | 20 | 20 | 11 | 8 | 26 |
| | | 0.0050mm | [illegible] | 36 | 32 | 70 | 13 | 38 | 6 | 19 | 27 | 62 | 1 | 16 | 11 | 17 | 16 | 14 | 8 | 5 | 16 |
| | | 0.0036mm | [illegible] | 32 | 26 | 60 | 12 | 34 | 6 | 18 | 26 | 53 | 1 | 12 | 9 | 14 | 14 | 12 | 7 | 5 | 14 |
| | | 0.0010mm | [illegible] | 17 | 10 | 30 | 7 | 17 | 3 | 9 | 6 | 30 | 1 | 4 | 6 | 6 | 5 | 7 | 2 | 3 | 4 |
| LOS ANGELES, GRADE A-12, PERCENT LOSS | | | | | | | | | | | | | | | | | | | | | |
| LIQUID LIMIT | | | 4 | 26 | 36 | 62 | 17 | 39 | | | 24 | 48 | 32 | 24 | 30' | 22 | 22 | 27 | 19 | | 22 |
| PLASTIC LIMIT | | | 2 | 18 | 18 | 25 | 14 | 20 | | | 15 | 22 | 25 | 18 | 15 | 19 | 19 | 22 | 17 | | 18 |
| PLASTIC INDEX | | | 2 | 8 | 18 | 37 | 3 | 19 | | | 9 | 26 | 7 | 6 | 14 | 3 | 3 | 5 | 2 | | 4 |
| PEBBLE COUNT (Percent) | | Limestone | | | | | | | | | | | | | | | | | | | |
| | | Quartzite | | | | | | | | | | | | | | | | | | | |
| | | Volcanic | | | | | | | | | | | | | | | | | | | |
| | | Chert | | | | | | | | | | | | | | | | | | | |

* Grade B-11 (Los Angeles abrasion, G-14)
' Test performed by U. S. Bureau of Public Roads (Liquid limit, R-24)
† Located west of mapped area and north of Delta.

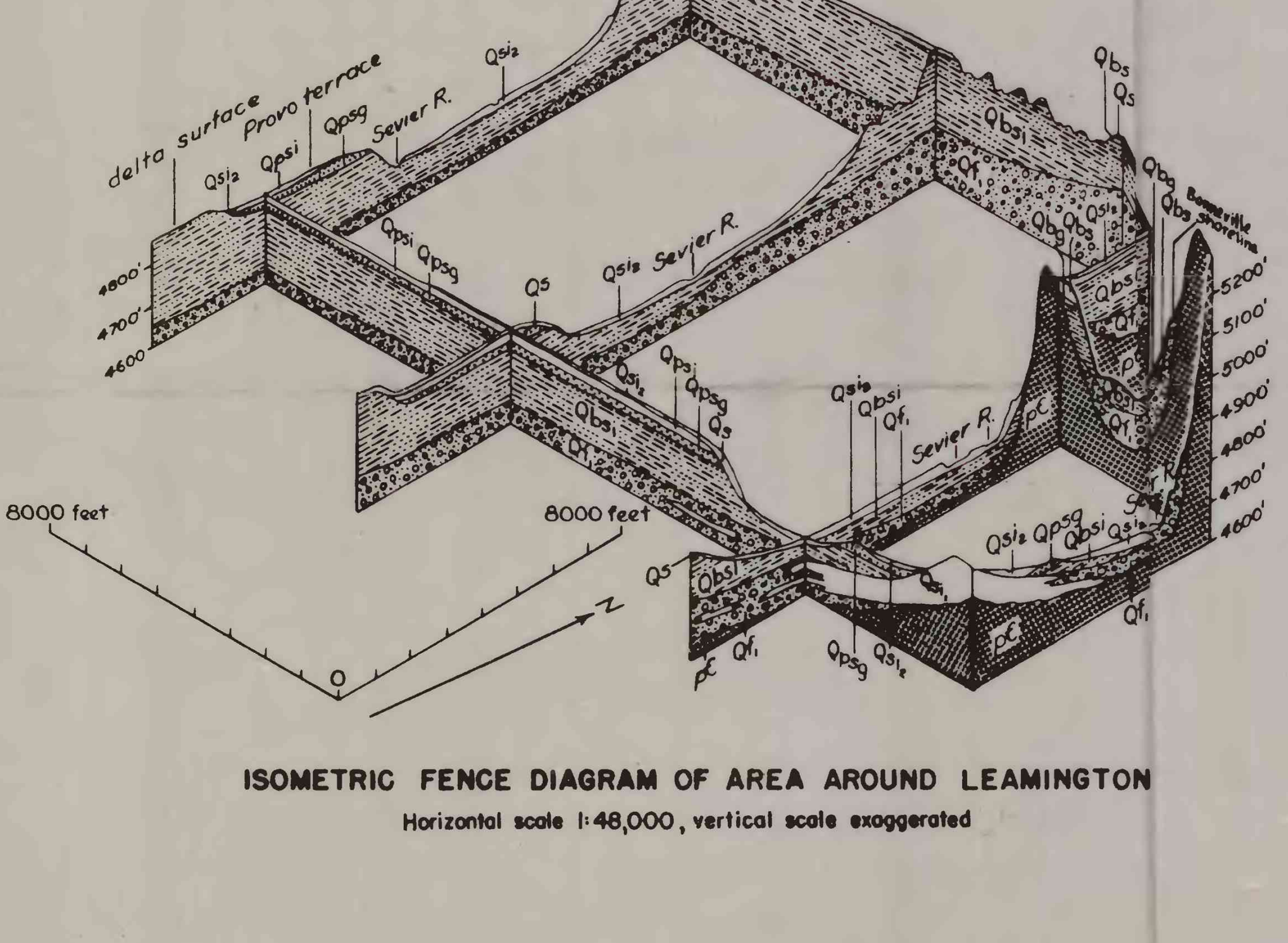
Tests by the U. S. Bur. Mines of one sample of blocky clay from R-14 indicate that this material is not commercially usable as ceramic or oil bleaching clay.

## AGE RELATIONS AND ENVIRONMENT OF DEPOSITION OF QUATERNARY DEPOSITS

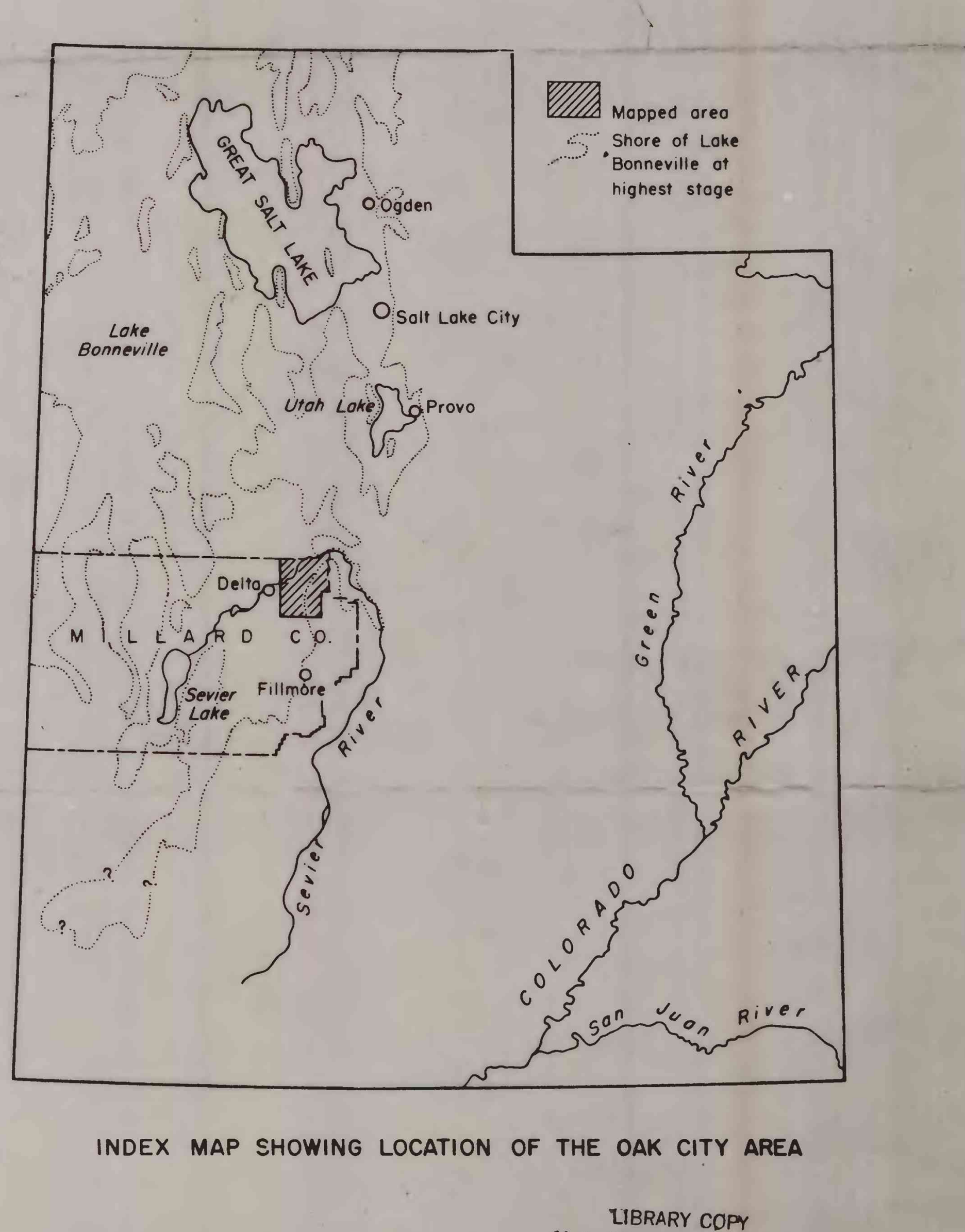
| | | Environment of deposition: Lacustrine | Environment of deposition: Fluvial | Environment of deposition: Eolian | Lake stage |
|---|---|---|---|---|---|
| Pleistocene and Recent | Post-Provo deposits | Qgp<br>Gypsite | Qsi$_2$ Silt<br>Qf$_2$ Alluvial fan<br>Qsg Sand and gravel | Qs<br>Sand | Stansbury (?) and later |
| Pleistocene | Provo formation | Qpsi<br>Silt | Qpsg<br>Sand and gravel | Qps<br>Sand | Provo |
| | Bonneville and Alpine formations undifferentiated | Qbr Beach rubble<br>Qbg Sand and gravel<br>Qbsg Sand and gravel<br>Qbs Sand<br>Qbsi Silt and clay | | | Bonneville and Alpine |
| | Pre-Lake Bonneville deposits | | Qsi$_1$ Silt<br>Qf$_1$ Alluvial fan | | |



**GEOLOGIC SECTIONS ALONG LINES A-A' AND B-B'**
Horizontal scale 1:48,000, vertical scale exaggerated



**ISOMETRIC FENCE DIAGRAM OF AREA AROUND LEAMINGTON**
Horizontal scale 1:48,000, vertical scale exaggerated



**INDEX MAP SHOWING LOCATION OF THE OAK CITY AREA**