DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

MISCELLANEOUS INVESTIGATIONS SERIES
MAP I–1830
Explanatory pamphlet accompanies map

GEOLOGIC MAP OF THE LYNNDYL 30- BY 60-MINUTE QUADRANGLE, WEST-CENTRAL UTAH

By
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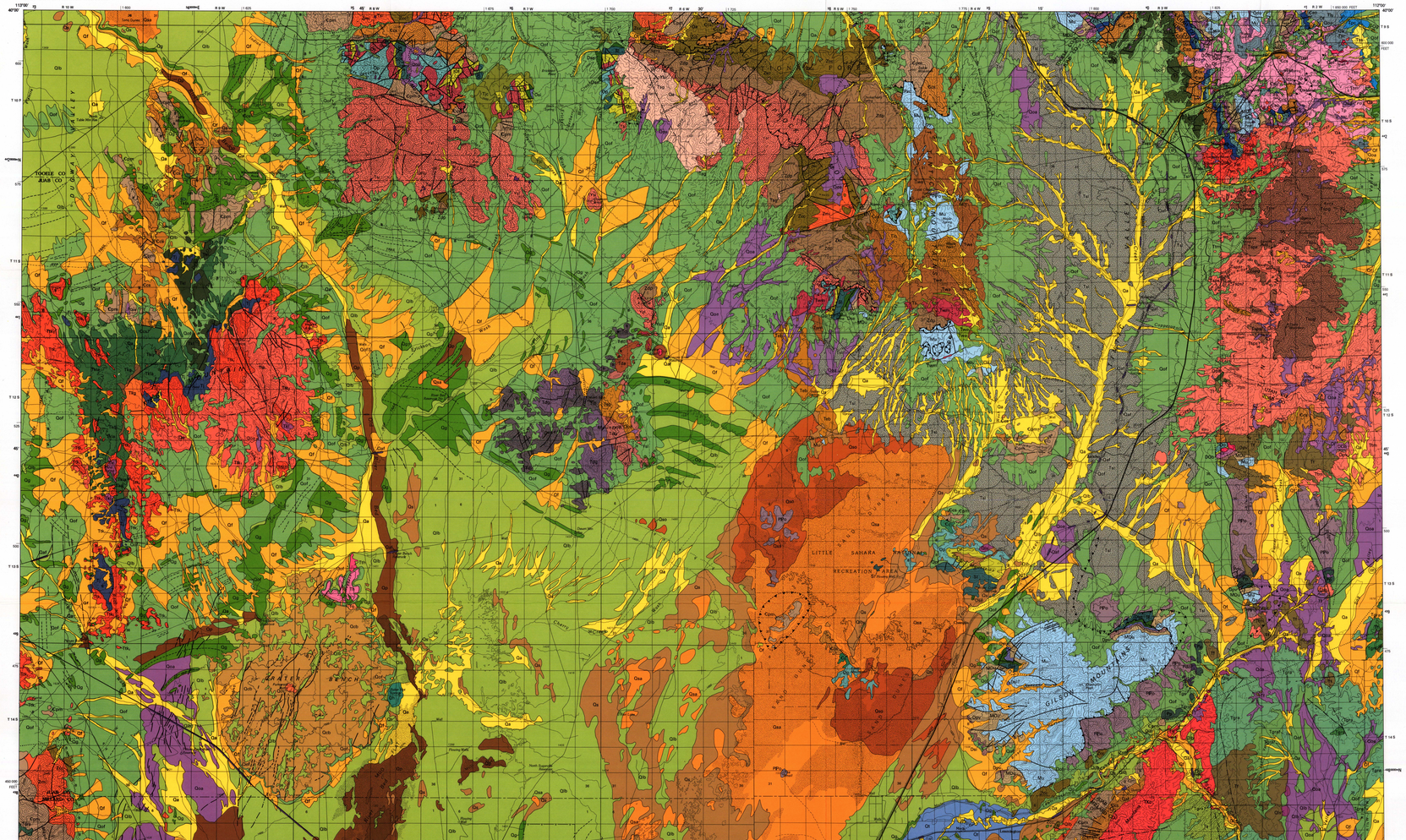

DESCRIPTION OF MAP UNITS

Qa ALLUVIUM (HOLOCENE)—Stream, river, and channel deposits consisting of clay to cobble-size, poorly sorted, locally stratified, and generally undissected detrital material. Commonly less than a few meters thick but locally may reach 10 m. Locally may include alluvial fan and colluvial and stream terrace deposits (Qt). Overlies Lake Bonneville shoreline features

Qaf ALLUVIAL FAN DEPOSITS (HOLOCENE)—Fan-shaped deposits of poorly sorted alluvial fan deposits of sand and gravel, largely derived from older alluvial (Qoa) and older fan deposits (Qof). Deposits are crudely stratified, subhorizontal to moderately dipping. Thickness is usually less than 5 m. Commonly overlie the older alluvial deposits. Locally may include Lake Bonneville (Qa) and older fan deposits (Qof). Generally undissected and smaller in areal extent and volume than older fan deposits

Qe EOLIAN SAND, UNDIVIDED (HOLOCENE)—Windblown loose to weakly consolidated, coarse- to fine-grained quartz sand and silt with some clay forming flat-lying and cross-bedded deposits, active dunes, and stabilized dunes derived principally from Lake Bonneville deposits to the south-southeast. Largely divided into:

Qea Active dunes—Loose sands in south-central part of map area, part of which is designated Little Sahara National Recreation Area. In places active dunes overtop bedrock ridges whose exposure varies with the amount of wind action, for example, the Sand Hills. Thickness is unknown but in places the dunes are more than 20 m high

Qeo Old dunes—Weakly consolidated sand in dunes which appear to be stabilized, at least in part, by a light cover of vegetation. Thickness unknown but in places the old dunes are more than a few vertical decimeters of more than 60 m

Qf PLAYA DEPOSITS (HOLOCENE)—Unconsolidated dark-lying deposits of silt and moderately expansive clay derived mostly from Lake Bonneville sediments that accumulated in closed basins in or near the Old River Bed. Thickness unknown but probably does not exceed a few meters

Qls LANDSLIDE DEPOSITS (HOLOCENE)—Irregular bodies of rock and soil that have moved downward and outward from adjacent source areas. Mostly more exist than are shown. Some may be pre-Holocene in age

Qfi ARTIFICIAL FILL (HOLOCENE)—Man-made debris, slag heaps, mine dumps, mill tailings, and earthworks constructed from local materials. Some, such as embankments for dams, highway and railroad roadbeds, and engineering structures are engineered fills; others are random accumulations of various materials. Although not shown as the artificial fill unit, much of the Intermountain Power Project site is covered with graded and compacted local and imported earth materials

Qt STREAM TERRACE DEPOSITS (HOLOCENE)—Unconsolidated, poorly sorted alluvial deposits of silt, sand, and gravel forming a crudely layered nearly flat-lying veneer on older geologic units adjacent to modern drainage channels. Mapped only along the Sevier River near Leamington where they may be as much as 10 m thick

Qlb HOT SPRING DEPOSITS (HOLOCENE AND PLEISTOCENE)—Chiefly light-gray clay, silt, and sand and indistinctly layered marlstone deposited in a spring mound. Mound has built up around hot springs in part by precipitation of minerals from spring water but largely by entrapment of eolian sediment by vegetation and sad grass. Exposed thickness is less than 5 m. Mapped only at Baker Hot Springs on west side of Crater Bench

Qlb DEPOSITS OF LAKE BONNEVILLE (PLEISTOCENE)—Lake sediments which consist of interlayered white, light-gray, brown, tan, and yellowish-gray clay, silt, sand, marl, and gravel. The clay, silt, and sand range from light- to yellowish-gray and tan to brown depending on the degree of desiccation and weathering, the light colors prevailing in natural outcrops; the fine clastic sediments commonly occur as alternating layers. Well-exposed east Leamington where thickness exceeds 50 m. Marl, widely exposed in southwest quarter of map area, is yellowish-gray to white and composed almost entirely of minute ostracod shells; most of the marl is laminated and massive but some is friable. In several places the marl is underlain by rusty-colored gravel, possibly representing one or more old soil horizons. Maximum thickness of exposed marl is 5 m on east side of Drum Mountains. Locally the land surface is strewn with oolitic foreset or gastropod shells coated with calcium carbonate. Black basaltic ash is present in marl near Leamington (Varnes and Van Horn, 1961; 1984), and rhyolitic ash is present in lake beds west of Lynndyl (Kratt and Patterson, 1980); radiocarbon age dates from shells adjacent to basaltic ash horizons range from about 11,000 to more than 32,000 B.P.; dates from shells west of Lynndyl range from about 11,000 to 12,700 ±B.P. The rhyolitic ash correlates with the Bishop Tuff (700,000 ±B.P.) and fission-track dates from zircons in the ash give an age of 730,000 ±70,000 B.P. (Rowley and Pattenson, 1980)

Qrb GRAVEL AND SAND DEPOSITS (PLEISTOCENE)—Spits, bay-mouth bars, tombolos, cuspate forelands and bars, and crescent beaches present at or below the Bonneville shoreline, which ranges in elevation from 1550 to 1593 m (Currey, 1982) across this quadrangle; features are especially well developed in west half of map area. Colluvial largely of reworked old alluvial fan deposits and contain moderately well-sorted sand- to cobble-size rounded clasts. Mostly lacustrine bar deposits but include some fluviatile stream terrace gravels interbedded in lake sediments along the Old River Bed and along the Sevier River between Leamington and Lynndyl (Varnes and Van Horn, 1961; 1984). Include The Snowplow (southwest corner of Simpson Mountains), Reservoir Butte and Cup Butte (see fig. 6) of Gilbert (1890) and numerous other well-defined and well-preserved crane shoreline deposits in the Silver Ely Hills, west slope of the Simpson Mountains, Keg Mountain and adjacent to Desert Mountain, and the seven bench deposits of Gulpatch and Black Rock Hills. The Hogback of Crater Bench. Locally the gravels are cemented with calcareous tufa. The gravel and sand deposits range in thickness from a few meters to beach deposits to several tens of meters in spits, cuspate forelands, and bars

Qoa OLDER ALLUVIUM (PLEISTOCENE)—Stream, river-channel, and basin deposits consisting of clay to small boulder-sized detrital material. Poorly sorted, crudely stratified, and moderately to deeply dissected. Thickness range from a few to tens of meters. Locally includes old stream terrace deposits

Qof OLDER FAN DEPOSITS (PLEISTOCENE)—Semi-consolidated, poorly sorted alluvial deposits of sand and gravel forming large fans bordering upland areas. Deposits, several tens of meters thick, are dissected and have given rise to the sloping fan surface, and commonly are deeply dissected. Older fan deposits lower than the Bonneville shoreline in many places were reworked by wave action and marked by strand lines. Locally include coarse- and fine-grained deposits of Lake Bonneville, pediment gravels, and older alluvium (Qoa). Include talus deposits in the Shepcock Mountains and wave-worked talus deposits surrounding Crater Bench. In southeast corner of map area include loess, alluvium and colluvium, pre-Wisconsin (glaciation) soil, and landslides (Goode, 1961), and east of Eureka include old stream terrace gravels (Morris and Lovering, 1979)

Qsl SALT LAKE FORMATION (PLIOCENE AND MIOCENE)—Predominantly reddish-brown to gray-brown semi-consolidated fine-grained calcareous clay, with lesser amounts of green and red tuffaceous bentonitic clay, light-gray to white marly limestone, and thin pebble to cobble gravel lenses. Includes a poorly exposed section of reddish-brown to pink sandy silt and clay more than 30 m thick unconformably overlain by Quaternary basalt at the south edge of Crater Bench. Includes some tuffaceous deposits thought to correlate with the Huckleberry Ridge ash bed dated at 2.20 m.y. (H.T. Morris, oral commun., 1983; Izett and Wilcox, 1982). Thickness exceeds 600 m (Morris and Kopf, 1979)

Tfs FLAGSTAFF LIMESTONE (EOCENE AND PALEOCENE)—Cream-colored silty, sandy, and algal limestone, lesser sandstone and pebble conglomerate present only in extreme southeast corner of map area and where a tongue of red, well-cemented cobble conglomerate is interlayered with the limestone. Section exposed is 60 m thick

TKc CANYON RANGE FORMATION OF STOLLE (1978) (PALEOCENE AND (OR) UPPER CRETACEOUS)—Synorogenic poorly-sorted, well-weathering, weakly-cemented, pebble to cobble conglomerate with brick-red sandstone and shale interbeds overlain by an interbedded sequence of yellowish-orange to purplish-gray coarse to fine clastic and limestone strata. Correlated with the Flagstaff, North Horn, and Price River Formations farther east. Present along east side of the Canyon Mountains. Originally mapped by Christiansen (1952) as the Upper Cretaceous Indianola(?) Group. Called the Upper Cretaceous and Paleocene North Horn Formation, Price River Formation and Indianola Group undivided by Campbell (1979), and mapped by Higgins (1982) as the Cretaceous and Tertiary Conglomerate of Lawrence and Indianola Group. Includes large slide blocks of limestone. About 1,050 m thick

TKn NORTH HORN FORMATION (PALEOCENE AND UPPER CRETACEOUS)—Brick-red conglomerate, sandstone, siltstone and some silty and sandy limestone. Present only in extreme south-east corner of map

EXTRUSIVE AND SEDIMENTARY ROCKS

Qctb BASALT OF CRATER BENCH (PLEISTOCENE)—Black, fine-grained flows of basaltic andesite, grading from vesicular to non-vesicular upwards from base of flow units. Same as Furnarolo Butte flows of Hogg (1972) and basalts of Crater Bench of Gulpatch and Rush (1981). Overlies lacustrine deposits of the Salt Lake Formation; overlain by Lake Bonneville deposits. K-Ar age determined as 0.88 m.y. (Peterson and Nash, 1980) and 0.95±0.1 m.y. (Gulpatch and Rush, 1981). Maximum thickness estimated to be about 180 m near Furnarolo Butte thinning to a few meters or less at the margin

Qci CINDER CONE DEPOSITS (PLEISTOCENE)—Remnant of cinder cone around a vent, presumed source of the basalt of Crater Bench (Qctb). Consist of densely welded cinders intruded by fine-grained dense basalt (Gulpatch and Rush, 1981). Cone is about 1 km in diameter

Th BASALT OF THE HOGBACK (MIOCENE)—Black vesicular tholeiitic basalt flows as much as 45 m thick that form The Hogback of Crater Bench, Gulpatch Hill, and Black Rock Hills (Hogg, 1972). K-Ar age 5.26±0.42 m.y. (Gulpatch and Rush, 1981), and 6.03 m.y. (Peterson and Nash, 1980). Included in the Quaternary basalt flows unit by Morris (1978). Age is early Pliocene

Tc CONGLOMERATE (MIOCENE)—Reddish-brown conglomerate and interlayered sandstone containing sand- to boulder-size clasts of white to pink quartzite and lesser amounts of dark-gray limestone, and granite, rhyolite, and basalt. The conglomerate locally is cemented with calcium carbonate and resistant to erosion. Thickness of exposed section exceeds 229 m. A thin tuff bed is present near base of section and clasts of the Topaz Mountain Rhyolite are present near top of section. Mapped only at north end of Crater Bench as Tertiary conglomerate by Hogg (1972), Peterson and Nash (1980), and Gulpatch and Rush (1981). Age is late Miocene

Ttm TOPAZ MOUNTAIN RHYOLITE (MIOCENE)—Chiefly light-gray alkali rhyolite flows with some black vitrophyre at base of flow units and some white to tan interbedded stratified tuff. Four fission-track and two K-Ar dates of flows in the type area range from 6.1±0.4 to 6.8±0.3 m.y. (Lindsey, 1979). Included in the quartzose sandstone member of Morris (1978). Age is late Miocene. On this map divided into the rhyolite of The Hogback (Ttmh) and the rhyolite flows, plugs, and dikes (Ttmr) of Hogg (1972)

Ttmh Rhyolite of The Hogback—Light-gray flow-banded rhyolite with some black vitrophyre, local lithophysae, and some pink to white quartz and sanidine phenocrysts as much as 6 mm long and quartz. Lithophysae as large as 2 cm in diameter in the rhyolite are filled with drusy quartz crystals. Weathers to a coarse irregular vuggy surface. Exposed in Gulpatch Hill and as much as 60 m thick in Crater Bench. Thickness exceeds 40 m. Equivalent to the rhyolite of The Hogback of Gulpatch and Rush (1981). K-Ar dates are 6.0±0.28 m.y. (Metzner and others, 1978) and 6.18 m.y. (Peterson and Nash, 1980)

Ttmr Rhyolite flows, plugs, and dikes of Keg Mountain—Light-gray to reddish-gray flows, plugs, and dikes of aphanitic to porphyritic rhyolite; some units have chilled margins of obsidian and spherulitic rhyolite, and locally include lithophysal zones, minor flow breccia, tan to white compact friable tuff locally silicified or welded, and gray quartz latite porphyry containing numerous phenocrysts of quartz, sanidine, and plagioclase. Total thickness unknown but thought to exceed a few hundred meters. These volcanic rocks extend westward from the type area in the Thomas Range (Lindsey, 1979) and also contain accessory topaz, hematite, biotite, and pseudobrookite but in lesser amounts than in the type area (Staub, 1975). Lithophysae locally in successive flow units. Tilt, being the older, commonly separated by tuff and (or) vitrophyre from the younger Ttk flow. Includes the Keg Mountain rhyolite unit, porphyritic rhyolite of West Mountain unit, Keg Mountain tuff unit, and Drum Mountain rhyolite unit of Staub (1975) and the rhyolite of Keg Mountain of Hogg (1972) and Lindsey and others (1975) in Keg Mountain, and rhyolite flows of Drummer (1980) in the Drum Mountains. Two fission-track dates of flows in Keg Mountain indicate an age of about 8 m.y. (Lindsey, 1979; Lindsey and others, 1975)

Tebt EXTRUSIVE BRECCIA (MIOCENE)—Material erupted from breccia pipes (Tib) during early explosive stage consisting of small fragments to large blocks of Precambrian to Tertiary sedimentary and igneous rocks in a matrix of tuffaceous breccia containing shattered crystals of quartz, feldspar, and biotite. Widely exposed in the southern Sheepcock Mountains (Morris and Kopf, 1970b; Morris, 1978) where it may be in excess of 90 m thick; mapped as rhyolite porphyry by Kattenhorn (1968) and as the Diamond Peak complex by Rees and others (1973) in Desert Mountain where it is exposed over a vertical distance of more than 200 m

Tss SILVER SHIELD QUARTZ LATITE (MIOCENE)—Medium- to dark-gray coarsely porphyritic flows and dikes in northeast corner of map area. Phenocrysts of plagioclase, quartz, biotite and augite up to 15 mm long are set in a very fine grained to aphanitic matrix with a high proportion of K-feldspar and quartz. The Silver Shield has a maximum thickness of 38 m (Morris and Lovering, 1979). Age is considered middle Miocene based on K-Ar dates ranging from 17.9±0.5 to 18.3±0.5 m.y. (Laughlin and others, 1969). Included in the younger intermediate volcanic rocks unit by Morris (1978)

Tbc BINGHAM CREEK CONGLOMERATE (MIOCENE)—Grayish-tan to reddish-brown conglomerate composed of sub-angular to rounded, pebble- to boulder-size monolithologic volcanic clasts interlayered with silty to grit-size volcanic debris. Conspicuously bedded; lensing and channeling are common. Individual beds may be poorly- or well-sorted. The Pinyon Creek Conglomerate is mapped only in the northeast corner of map, where it is more than 300 m thick. Included, along with Miocene conglomerate (Tc) of The Hogback, in the Miocene unit of Morris (1978). Age is early Miocene

J JASPINITE (JURASSIC?)—Silicified and opalized Tertiary volcanic and Paleozoic carbonate rocks whose origin is apparently related to Oligocene Jasperoid deposits. Includes silicified breccia on southeast side of Gilson Mountains on or near trace of Leamington transcurrent fault

Tt JUDD CREEK LATITE (OLIGOCENE)—Gray to reddish-brown latite porphyry with phenocrysts of glassy to chalk-white andesine, up to 5 mm long, some quartz, and scarce biotite in a microcrystalline to aphanitic groundmass; the texture is progressively finer grained away from center of outcrop area. Thickness unknown but estimated to be greater than 60 m. Present in the southern Sheepcock Mountains, where named for Judd Creek. Latite by Thomas (1958), and in the western Sheepcock Mountains; on this map includes several small isolated volcanic outcrops on west side of Drum Mountains mapped as pitchstone and trachyte by Gilbert (1890). Pleocenic volcanic rocks are silicified locally along contact with overlying latite flows and quartz. Lithophysae as large as 2 cm in diameter in the rhyolite are filled with drusy quartz crystals. Weathers to a coarse irregular vuggy surface. Exposed thickness of flows (Tt) at north tip of Crater Bench. Thickness exceeds 40 m. Equivalent to the rhyolite of The Hogback of Gulpatch and Rush (1981). K-Ar dates are 6.0±0.28 m.y. (Metzner and others, 1978) and 6.18 m.y. (Peterson and Nash, 1980)

Tbt LAGUNA SPRINGS VOLCANIC GROUP (OLIGOCENE)—Consists of the Tintic Detrital Latite, Pinyon Quartz Latite, and North Standard Latite in the East Tintic Mountains (Morris and Lovering, 1979), all of which have similar chemical and mineralogical compositions and all contain hornblende which distinguishes them from rocks of the underlying Tintic Mountain Volcanic Group (Ttm). These are the extrusive equivalents of the monzonite porphyry of the Silver City stock (Tsc). The Tintic Detrital Latite consists of a quartz latite member and a lower tuff member with a combined thickness of 0-122 m. The flow member is medium-gray to dark-reddish-brown, massive, medium-grained latite porphyry, characterized by large glassy to chalk-white phenocrysts of feldspar, dark black biotite crystals, and rare phenocrysts of hornblende and augite; the tuff member is a buff to white fine to coarse-grained heterogeneous assemblage of volcanic ash, lapilli tuff, and agglomerate containing up to boulder-sized clasts. The Pinyon Quartz Latite consists of an upper flow member and lower tuff member, both of which are virtually indistinguishable from their counterparts in the Tintic Detrital Latite, with a combined thickness of 0-335 m. The flow member is medium- to purplish-gray, massive, medium-grained latite porphyry; the tuff member consists of a medium-gray fine-grained boulder tuff and agglomerate. The North Standard Latite consists of an upper flow member and a lower tuff member with a combined thickness of 0-180 m. The flow member is dull-purplish-gray to brownish-gray, massive fine- to medium-grained latite porphyry, the freshest outcrops of which show fragments of vitrophyre in a matrix of lighter-colored vitrophyre speckled with glassy to chalk-white phenocrysts of plagioclase and banded crystals of biotite; the tuff member is a gray to white heterogeneous agglomerate containing boulders up to 30 cm in diameter in a matrix of volcanic ash and gravel. Apparent isotopic age of the Laguna Springs Volcanic Group (Tbt) is about 27 m.y. (Laughlin and others, 1969). Thickness is 32.2±1.0 and 32.3±1.0 m.y. (Laughlin and others, 1969). Total thickness 0-640 m

Ttm TINTIC MOUNTAIN VOLCANIC GROUP (OLIGOCENE)—Consists of the Big Cottonwood Latite, Latite Ridge Latite, and Copperopolis Latite in the East Tintic Mountains (Morris and Lovering, 1979). These three units have similar mineralogic compositions but represent three separate eruptive episodes. Intrusive rocks related to this group are represented by the monzonite porphyry stock of Silver City (Tsc). The Big Cottonwood Latite consists of an upper flow member and a lower tuff member with a combined thickness of 0-640 m. The flow member is medium- to dark-gray, compact, fine-grained latite porphyry characterized by small white plagioclase phenocrysts up to 3 mm long and lustrous grandes of biotite; the tuff member is buff to white, fine-grained, well-bedded to strongly altered to white clay stained yellow, brown, and black by iron and manganese oxides. Latite Ridge Latite is a dark-gray hornblende-bearing latite porphyry; the tuff member consists of a medium-gray to brownish-black, densely welded, fine-grained tuff and medium-gray to brownish-gray, massive, medium-grained latite porphyry. The welded tuff is distinguished by white, lenticular, flattened pumice lapilli. The lower member is medium-greenish-gray to white, depending on degree of hydrothermal alteration, massive, medium-grained to coarse and mostly of uniform texture. The Copperopolis Latite consists of upper and lower agglomerate units separated by flow and tuff units, with a combined thickness of 0-3,800 m. It rests unconformably on the Packard Quartz Latite. East of the Lynndyl quadrangle these units are overlain by additional flow and tuff units indicating a succession of explosive eruptions and quiet extrusions. The upper unit, the middle agglomerate member of Morris (1975), is a massive boulder agglomerate containing rounded clasts of dark-gray latite in a matrix of volcanic gravel and tuff. The next unit, the lower flow member of Morris (1975), is dark-greenish-gray to reddish-brown, fine-grained to aphanitic, massive latite porphyry. The phenocrysts of labradorite, augite, and hypersthene up to 5 mm long are recognizable only by reflections from their cleavage faces. The underlying tuff member is largely gray-green to white, fine- to medium-grained air-fall tuff, containing fragments of feldspar, augite, hypersthene, and magnetite crystals in a matrix of comminuted minerals and glass shards. The lower agglomerate member of Morris (1975) is a dark-greenish-gray massive breccia containing lenses of lapilli and boulder tuff and minor thin flows of dark-gray latite. A whole-rock age determination of the Big Cottonwood Latite yielded an anomalous age of 35.3±1.4 m.y. (Morris and Lovering, 1979). Combined total thickness is 0 to more than 4,300 m

Tgb GOLDENS RANCH FORMATION (OLIGOCENE)—Volcano-sedimentary rocks consisting mainly of agglomerate but containing lenses of conglomerate, sandstone, and algal limestone. Present in southeast corner of map area adjacent to Sage Valley and northeastward in Long Ridge where originally defined by Maxwell (1951a, 1951b). Largely temporally correlative with the Tintic Mountain Volcanic Group (Ttm). Divided into:

Tgra Agglomerate—Chiefly light-colored weakly cemented volcanic-cobble conglomerate more than 250 m thick. At base includes the pinkish-gray andesite crystal tuff unit of Higgins (1982) which correlates with the Canyon Range Formation of Stolle (1978) (TKc) east of the Sevier River. Largely equivalent to the middle agglomerate member of the Copperopolis Latite of the Tintic Mountain Volcanic Group (Ttm) and some of the Laguna Springs Volcanic Group (Tbt). Conglomerate unit by Maxwell and Hershey manganese-bearing carbonate veins, some as much as 2 m wide

Tgrs Sage Valley Limestone Member—Light- to medium-gray, thin- to medium-bedded algal limestone lenses interbedded with volcanic conglomerate. In Long Ridge the limestone lenses are about 250 m above the basal contact and are as thick as 90 m. Unit of Muessig (1951b)

Tp PACKARD QUARTZ LATITE (OLIGOCENE)—Chiefly pinkish- or lavender-gray medium-grained quartz latite porphyry. Generally divisible into four parts: an upper unit of dark-green to black vitrophyre and tuff as much as 50 m thick; a massive middle unit of quartz latite porphyry locally more than 820 m thick; a lower unit of dark-green to black vitrophyre and tuff as much as 60 m thick; and a basal unit of fine-grained tuff as much as 210 m thick (Morris and Lovering, 1979) but averaging less than 10 m thick. Biotite separated from the quartz latite porphyry yielded isotopic ages of 32.8±1.0 and 32.7±1.0 m.y. (Laughlin and others, 1969). Chemically and mineralogically similar to the Swansea Monzonite (Tsw). Present in the East Tintic Mountains in northeast corner of map area, and in lithologically and stratigraphically equivalent to the Fernow Quartz Latite (Tf) of the southern East Tintic Mountains and Sage Valley area. These two units represent the oldest post-tectonic volcanic units in the East Tintic Mountains. Age is middle Oligocene

Tf FERNOW QUARTZ LATITE (OLIGOCENE)—Light- to medium-gray medium-grained welded tuff containing phenocrysts of quartz, sanidine, andesine, and biotite and lesser amounts of black obsidian in a matrix of partly welded glass shards. Locally includes thin patches of air-fall tuff at base. Present in the southern East Tintic Mountains and Sage Valley area where it is 0-460 m thick. Lithologically and temporally equivalent to the Packard Quartz Latite (Tp). Age is middle Oligocene

Tsw SUNRISE PEAK MONZONITE PORPHYRY (OLIGOCENE)—Medium- to dark-gray, coarse-grained porphyry with large, euhedral phenocrysts of augite, hypersthene, biotite, labradorite, and orthoclase in an aphanitic groundmass. Intrudes the Packard Quartz Latite and appears closely related to the extrusive rocks of the Tintic Mountain Volcanic Group (Ttm) (Morris and Lovering, 1979, p. 36). Age is middle Oligocene. Divided into:

Tsw Sunrise Peak stock—Stock, plugs, dikes, and other large steeply dipping bodies. Large map unit (Tsw?) south of Sunrise Peak includes dikes, plugs and dikes of latite porphyry that may be the eruptive source of the Tintic Mountain Volcanic Group (Morris, 1975)

Tsg Gough and Dry Ridge sills—Gently east-dipping intrusive bodies originally part of a single sheet derived from the Sunrise Peak stock (Morris, 1975; Morris and Lovering, 1979)

Tsw SWANSEA QUARTZ MONZONITE (OLIGOCENE)—Pale-grayish-pink to grayish-green to buff and white, depending on degree of freshness and type of alteration, medium- to coarse-grained, granitic to porphyritic quartz monzonite. Nearly identical to the Packard Quartz Latite (Tp) in chemistry and mineralogy (Morris, 1975) and relative age. The Swansea stock lies between Silver City and Mammoth in the East Tintic Mountains

Tsb BASALT SILLS OF GILSON MOUNTAINS (OLIGOCENE)—Black porphyritic basalt containing strongly zoned phenocrysts of labradorite in a matrix of plagioclase microliths and glass. Present on southeast side of Gilson Mountains as sills in the section composed of the Oquirrh Group (IPPu) and Diamond Creek Sandstone (Pdc). Intrusive rocks of Higgins (1982). Up to 50 m thick

Tkg GRANODIORITE STOCKS OF KEG MOUNTAIN (OLIGOCENE)—Gray-green massive granodiorite porphyry containing phenocrysts of plagioclase, biotite, and quartz in a microcrystalline groundmass, and dark- to medium-gray massive diorite porphyry with phenocrysts of plagioclase and biotite. Includes rocks resembling rhyolite porphyry mapped as the Keg Mountain lignimbrite by Erickson (1963), the quartz-latite welded ash-flow tuff unit by Shawe (1972), the Keg granodiorite porphyry unit and the diorite porphyry part of the Keg Spring Andesite of Staub (1975)

ROCK UNITS OF AREA A

Dsi SIMONSON DOLOMITE (MIDDLE DEVONIAN)—Medium- and dark-brownish-gray, coarse- to medium-grained, color-banded dolomite. Present in the southern Sheepcock Mountains, where it contains a dolomite megabreccia less 122 m thick, and in the Gilson and eastern Simpson Mountains. Unconformity at top cuts out the Guilmette Formation in the West Tintic Mountains. Thickness ranges from 60 to 260 m

Sdy SEVY DOLOMITE (LOWER DEVONIAN)—Grayish-white-weathering, light-gray, fine-grained to dense dolomite, containing scattered grains of frosted clear quartz. Present in the east part of the Simpson Mountains, and in the Sheepcock, Black, and Gilson Mountains. About 370 m thick

Sl LAKETOWN DOLOMITE (MIDDLE SILURIAN)—Gray, aphanitic to coarse-grained, medium- to thick-bedded dolomite, locally interbedded with dark-brown to medium-gray, medium- to coarse-grained, thin-bedded crystalline cherty dolomite containing one or more stromatolite horizons. Present in east and south of the East Tintic Mountains in the upper plate of the Tintic Valley thrust fault. Thickness ranges from about 150 m in southeast corner of the East Tintic Mountains to 430 m in southern Sheepcock Mountains

Of FISH HAVEN DOLOMITE (UPPER ORDOVICIAN)—Light- to dark-gray, thin- to massive-bedded, medium- to coarse-grained cherty dolomite, with a massive ledge-forming rectified granular dolomite bed at top. Present in east two-thirds of map area. Thickness increases westward from 60 m in the Sheepcock Mountains to 245 m in southern Sheepcock Mountains

Os SWAN PEAK FORMATION (MIDDLE ORDOVICIAN)—Chiefly white to tan, medium-grained, well-sorted quartzite, with some beds and pockets of sandstone and some interbedded phosphatic quartzite at the base. Apparently lenses out eastward and southward; present only in the Sheepcock Mountains. Maximum thickness is about 215 m

Op POGONIP GROUP (MIDDLE AND LOWER ORDOVICIAN)—Chiefly light-blue-gray, thin- to medium-bedded, fine-grained limestone containing flat-pebble conglomerate layers, and locally includes an upper unit of shale. At the Bluebird Mine in Gilson Mountains, the shale is present in east two-thirds of map area. Thickness increases westward from 60 m in the Sheepcock Mountains to 245 m in southern Sheepcock Mountains

Ꞓs CARBONATE AND CLASTIC SEDIMENTARY ROCKS (MIDDLE CAMBRIAN)—Chiefly light- to dark-gray limestone and dolomite with some shale intervals. Consists of the Pierson Cove Formation, Wheeler Shale, Swasey Limestone, Whirlwind Formation, Dome Limestone, Chisholm Formation, Howell Limestone, and upper or Tatow Member of the Pioche Formation in the western and southern parts of map area (Dommer, 1980; Hodgkins, 1982), and of the Cole Canyon Dolomite, Marjum Formation, Wheeler Formation, Swasey Limestone, Whirlwind Formation, Dome Limestone, Chisholm Shale, Howell Limestone, and Tatow Member in the Sheepcock Mountains (Christie-Blick, 1983), and the Cole Canyon Dolomite, Bluebird Dolomite, Herkimer Limestone, Dunderberg Dolomite, Teutonic Limestone and Ophir Formation in the East Tintic Mountains (Morris and Lovering, 1979). Thickness ranges from 515 m in East Tintic Mountains to 1,150 m in Sheepcock Mountains

Ꞓpm PROSPECT MOUNTAIN QUARTZITE (LOWER CAMBRIAN)—Same description under Area A

Ꞓl CARBONATE ROCKS, UNDIVIDED (PALEOZOIC)—Present as a small thrust slice in the Sheepcock Mountains

ROCK UNITS OF AREA C

Ꞓk PARK CITY FORMATION (UPPER AND LOWER PERMIAN)— Chiefly gray, medium-bedded cherty dolomite of the Lower Permian Franson and Grandeur Members of the Park City Formation in southern Sheepcock Mountains; black, thin-bedded cherty phosphatic mudstone tongue of the Meade Peak Member of the Phosphoria Formation (Morris, 1977). Exposed in southern East Tintic and Gilson Mountains in the lower plate of the Tintic Valley thrust fault. About 150 m thick

Ꞓd DIAMOND CREEK SANDSTONE (LOWER PERMIAN)—Largely white to red, massive, friable, cross-bedded, calcareous sandstone with interlayered gray to pink dolomite and sandy dolomite. Exposed in southern Gilson East Tintic and eastern Gilson Mountains in the lower plate of the Tintic Valley thrust fault. About 150 m thick

IPPu OQUIRRH GROUP (LOWER PENNSYLVANIAN AND PERMIAN)—See description under Area B

Mu GREAT BLUE AND HUMBUG FORMATIONS AND DESERET LIMESTONE, UNDIVIDED (UPPER MISSISSIPPIAN)—Chiefly blue-gray, cherty limestone, light-gray limestone interlayered with medium- to coarse-grained quartzite sandstone, blue-gray, medium- to thick-bedded cherty limestone, and locally with thick units of quartzite sandstone and finale carbonaceous and phosphatic shale. Present in east half of map area. As much as 1,340 m thick in East Tintic Mountains

MDu GARDISON LIMESTONE (LOWER MISSISSIPPIAN) AND FITCHVILLE FORMATION (LOWER MISSISSIPPIAN AND UPPER DEVONIAN), UNDIVIDED—Chiefly prominently bedded, dark- to medium-blue-gray partly cherty limestone with abundant well-preserved fossils, and some blue argillaceous limestone, massive light-gray to white medium-grained limestone, blue-gray, thin-bedded shaly limestone, dusky-blue-gray, massive, cherty dolomite, quartzite, pinkish-gray silt-lithography limestone, and medium- to dark-gray, dense stromatolitic limestone. Present in east half of map area. The Gardison is wholly Early Mississippian. The Fitchville, as exposed in the East Tintic Mountains, is Early Mississippian and Late Devonian. In the Gilson and southern Sheepcock Mountains the Fitchville was thought to be wholly Early Mississippian but may contain Late Devonian strata. No Fitchville is present in unit MDu in the southern West Tintic Mountains (as much as 300 m thick in southern East Tintic Mountains

Dp PROVO PLAIN LIMESTONE (UPPER DEVONIAN)—Medium- to dark-blue massive limestone streaked with tan to light-brown silt and clay with a lower unit of buff to light-brown medium-grained massive quartzite. As mapped includes the Abbh Quartzite of Stringham (1942) in the southern Sheepcock Mountains. Maximum thickness is about 75 m

Ds SIMONSON DOLOMITE (MIDDLE DEVONIAN)—See description under Area A

Ꞓs SEVY DOLOMITE (LOWER DEVONIAN)—See description under Area A

Ꞓl LAKETOWN DOLOMITE (MIDDLE SILURIAN)—See description under Area A

Of FISH HAVEN DOLOMITE (UPPER ORDOVICIAN)—See description under Area A

Os SWAN PEAK FORMATION (MIDDLE ORDOVICIAN)—See description under Area A

Op POGONIP GROUP (MIDDLE AND LOWER ORDOVICIAN)—See description under Area A

Ꞓs CARBONATE AND CLASTIC SEDIMENTARY ROCKS (MIDDLE CAMBRIAN)—Chiefly light- to dark-gray limestone and dolomite with some shale intervals. Consists of the Pierson Cove Formation, Wheeler Shale, Swasey Limestone, Whirlwind Formation, Dome Limestone, Chisholm Formation, Howell Limestone, and upper or Tatow Member of the Pioche Formation in the western and southern parts of map area (Dommer, 1980; Hodgkins, 1982), and of the Cole Canyon Dolomite, Marjum Formation, Wheeler Formation, Swasey Limestone, Whirlwind Formation, Dome Limestone, Chisholm Shale, Howell Limestone, and Tatow Member in the Sheepcock Mountains (Christie-Blick, 1983), and the Cole Canyon Dolomite, Bluebird Dolomite, Herkimer Limestone, Dunderberg Dolomite, Teutonic Limestone and Ophir Formation in the East Tintic Mountains (Morris and Lovering, 1979). Thickness ranges from 515 m in East Tintic Mountains to 1,150 m in Sheepcock Mountains

Ꞓpm PROSPECT MOUNTAIN QUARTZITE (LOWER CAMBRIAN)—White to light-red, fine- to medium-grained, thick- to massive-bedded, moderately lidlapidary, sugary quartzite. Pebble beds are locally present near the lower part of the formation, and locally the upper part is shale. As mapped, unit includes all rocks of the Prospect Mountain Formation in the Sheepcock Mountains by Blick (1979) and in the Simpson Mountains by Thomas (1958) and in the Gilson and East Tintic Mountains (Morris, 1977). Exposed in southern East Tintic and Gilson Mountains in the lower plate of the Tintic Valley thrust fault. About 150 m thick

Zmi DIAMOND CREEK SANDSTONE (LOWER PERMIAN)—Largely white to red, massive, friable, cross-bedded, calcareous sandstone with interlayered gray to pink dolomite and sandy dolomite. Exposed in southern Gilson East Tintic and eastern Gilson Mountains in the lower plate of the Tintic Valley thrust fault. About 150 m thick

IPPu OQUIRRH GROUP (LOWER PERMIAN AND UPPER PENNSYLVANIAN)—See description under Area B

Mu GREAT BLUE AND HUMBUG FORMATIONS AND DESERET LIMESTONE, UNDIVIDED (UPPER MISSISSIPPIAN)—Same description under Area C

MDu GARDISON LIMESTONE (LOWER MISSISSIPPIAN) AND FITCHVILLE FORMATION (LOWER MISSISSIPPIAN AND UPPER DEVONIAN)—See description under Area B

DOb BLUEBELL DOLOMITE (DEVONIAN, SILURIAN, AND UPPER ORDOVICIAN)—Light- to medium-gray, massive, cherty, medium- to coarse-grained, moderately fossiliferous, locally mottled and cherty dolomite. Contains a conspicuous cherty zone near the middle, and medium-gray, thin- to medium-bedded, fine-grained laminated dolomite. Bluebell Dolomite is lithologically equivalent to the Laketown Dolomite. Formation is recognized only in the East Tintic Mountains. Thickness ranges from about 100