PROGRESS REPORT: GEOLOGIC MAP OF THE OGDEN 30' X 60' QUADRANGLE, UTAH AND WYOMING

YEAR 3 of 3

Original mapping by James C. Coogan and Jon K. King
Compilation by Jon K. King

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UTAH GEOLOGICAL SURVEY
a division of
Utah Department of Natural Resources
in cooperation with **U.S. Geological Survey**
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STATEMAP Agreement Nos. 1434-HQ-96-AG-01521,
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This progress report makes the results of the third year of mapping on a three year project available to the public. This map consists of original mapping by Coogan and King, with previous mapping compiled from many sources by King. Because the report is subject to review and may not conform to UGS policy and editorial standards, it may be premature for an individual or group to take action based on the contents. This material will not be reproduced when the final product has been released.

INDEX TO GEOLOGIC MAPPING, YEAR 3
(Numbers refer to maps as shown on figure 1.)

1 Bryant, Bruce, 1984, Reconnaissance geologic map of the Precambrian Farmington Canyon Complex and surrounding rocks in the Wasatch Mountains between Ogden and Bountiful, Utah: U.S. Geological Survey Miscellaneous Investigations Series Map I-1447, scale 1:50,000. [parts of **Kaysville**, **Peterson**, and **Snow Basin** quadrangles]

2 Coogan, J.C., 1998, Preliminary geologic maps of the **Meachum Ridge, Henefer,** and **Heiners Creek** quadrangles: Utah Geological Survey unpublished maps, scale 1:24,000 [minor revisions in 1999].

3 Coogan, J.C., 2000 (in review), Interim geologic maps of the **Peck Canyon**, **Lost Creek Dam**, and **Francis Canyon** quadrangles, Lost Creek drainage, Morgan, Rich, Summit, and Weber Counties, Utah: Utah Geological Survey Open-File Report, scale 1:24,000.

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5 Coogan, J.C., 1999, Preliminary geologic maps of the **James Peak**, **Sharp Mountain**, **Monte Cristo Peak,** and **Devils Slide** quadrangles: Utah Geological Survey unpublished maps, scale 1:24,000.

6 Coogan, J.C., and King, J.K., 1998, Preliminary geologic maps of the **Castle Rock, Wahsatch**, and **Porcupine Ridge** quadrangles: Utah Geological Survey unpublished maps, scale 1:24,000 [revised in 1999].

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and Weber Counties, Utah: U.S. Geological Survey Miscellaneous Investigations Series Map I-1606, scale 1:24,000.

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12 King, J.K., 1998, Preliminary geologic maps of the **Neponset Reservoir NW, Neponset Reservoir NE, McKay Hollow, Shearing Corral,** and **Murphy Ridge** quadrangles: Utah Geological Survey unpublished maps, scale 1:24,000.

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OGDEN 30' x 60' PRELIMINARY MAP UNITS

QUATERNARY (number suffixes show local levels/relative age, with “1" the youngest; other common suffixes are: o = older and y = younger; see correlation chart for unit suffixes)

Qa1, Qa2, Qa[p], Qab, Qay, Qao Stream and fan alluvium -- Sand, silt, clay, and gravel. Alluvium labeled Qa[p] and Qab are graded to the Provo (and slightly lower) and Bonneville shorelines of late Pleistocene Lake Bonneville, respectively. Near former Lake Bonneville, units labeled 1 and 2 are younger than Lake Bonneville; elsewhere relative-age numbers only apply to local drainages.

Qal1, Qal2 Stream alluvium, Holocene -- Sand, silt, clay, and gravel in channels and floodplains; composition depends on source area; suffixes 1 and 2 indicate ages where they can be separated in the area of former Lake Bonneville, with 2 including low terraces.

Qat2, Qat3, Qatp, Qaty, Qato, Qat4-7 Stream-terrace deposits -- Sand, silt, clay, and gravel in terraces above floodplains. Terraces labeled Qatp are graded to the Provo and slightly lower shorelines of late Pleistocene Lake Bonneville and are only present in Morgan and Mantua Valleys. Near former Lake Bonneville, units with suffixes 2 and 3 are younger than Lake Bonneville; elsewhere relative-age numbers only apply to local drainages and the lowest terraces are labeled 2.

Qaf1, Qaf2, Qafy, Qafp, Qafb, Qaf3, Qafo Alluvial-fan deposits -- Mostly sand, silt, and gravel that is poorly bedded and poorly sorted. Fans labeled Qafp and Qafb are graded to the Provo (and slightly lower) and Bonneville shorelines of late Pleistocene Lake Bonneville, respectively; unit Qaf3 is used where these fans can’t be separated. Near former Lake Bonneville, units with suffixes 1 and 2 are younger than Lake Bonneville and are shown as Qafy where they can’t be separated; here, unit Qafo is older than Lake Bonneville. Elsewhere relative-age numbers and letters only apply to local drainages.

QafO Lower and middle Pleistocene alluvial-fan deposits – Fans located above pre-Lake Bonneville older alluvial-fan deposits (Qafo) near Mountain Green; contain mostly sand, silt, and gravel that is poorly bedded and poorly sorted.

Qap Pediment-mantle deposits (also labeled as Qs = erosion surface with uncertain mantle thickness) -- Gravel, sand, silt, and clay alluvium and colluvium capping erosional surfaces.

Qac Alluvium and colluvium -- Includes stream and fan alluvium, colluvium, and, locally, mass-movement deposits.

Qc Colluvium -- Includes slopewash and soil creep; composition depends on local bedrock.

Qcg Colluvial and residual gravel deposits – Includes Quaternary gravel-armored

surfaces that don't resemble pediments; previously included in Huntsville fanglomerate.

Qmc Colluvium and mass-movement deposits, undivided – Includes landslide, slump, slopewash, and soil creep with subdued morphology on steep slopes.

Qm, Qmo Mass-movement deposits, undivided – Includes slides, slumps, and flows, as well as colluvium, talus, and alluvial fans that are mostly debris flows; composition depends on local sources. Qmo locally used where younger mass-movements (including landslides and slumps) are mapped.

Qms, Qms1, Qms2, Qms3, Qmsy, Qms4, Qmso Landslide and slump deposits (locally, unit involved is shown in parentheses) – Poorly sorted clay to boulder-sized material; locally includes flow deposits. Near former Lake Bonneville units with relative-age number suffixes were: 1) emplaced in the last 80 to 100 years; 2) are post Lake Bonneville in age; 3) were emplaced during or shortly after Lake Bonneville regression; and 4) were emplaced before Lake Bonneville transgression; extensive deposits in Lake Bonneville sediments in North Ogden and Kaysville quadrangles include earthquake liquefaction features. Suffixes y (as well as 1&2) and o (as well as 3&4) indicate probable Holocene and Pleistocene ages, respectively.

Qmt Talus, and lesser colluvium -- Angular debris at the base of and on steep slopes. Includes rock glaciers that form lobate mounds in cirques in the Wasatch Range; probably inactive.

Qg, Qgw Glacial till and outwash -- Mostly Pinedale (~15,000 to 30,000 yrs old) but probably includes Little Ice Age (1500 to 1800 A.D.) and may include Bull Lake (~130,000 to 150,000 yrs old) deposits; locally includes rock glaciers. Unit Qgw is outwash and, possibly, alluvially reworked outwash that obscures older deposits and bedrock.

Qly Lacustrine deposits other than those in Lake Bonneville – Fine-grained material and locally marsh deposits in lakes outside the Great Salt Lake basin; typically younger than Lake Bonneville deposits.

Qla Lake Bonneville deposits; and post- and pre-Lake Bonneville alluvial-fan deposits, undivided -- Mostly poorly sorted and poorly bedded sand, silt, and gravel.

Ql Lake Bonneville deposits, undivided.

Qlf Fine-grained lacustrine deposits -- Mostly clay, silt, and fine sand deposited offshore in Lake Bonneville. In the Kaysville quadrangle, deposits below the Gilbert shoreline are the same age as the shoreline, while deposits below the historic-highstand shoreline (4,213 feet [1,284.5 m]) of Great Salt Lake are recent.

Qls Lake Bonneville sand -- Mostly sand with some silt and gravel deposited nearshore; grades downslope into unit Qlf with decreasing sand content. Typically sand in the Ogden and Morgan Valleys.

Qlg Lake Bonneville gravel -- Mostly interbedded gravel and sand deposited along

beaches and slightly offshore.

Qdl, Qdlb Deltaic and lacustrine deposits in Lake Bonneville -- Mapped in Morgan and Ogden Valleys. Unit Qdlb is sand deposited at the mouth of Weber Canyon during the Bonneville highstand.

Qdf Fan-delta deposits in Lake Bonneville -- Alluvial fans that were deposited above (subaerially) and in Lake Bonneville (subaqueous).

Qd, Qdp, Qdb Deltaic deposits in Lake Bonneville -- Mostly sand, silty sand, and gravelly sand; suffixes p and b are for deltas at the Provo and slightly lower shorelines, and Bonneville shoreline, respectively.

Qsm Spring deposits -- Marshy areas in Kaysville quadrangle, and spring travertine downstream from Causey Spring in the Causey Dam quadrangle.

Qh Human disturbance -- Obscures original deposits by cover or removal.

Qx/Qy Thin Quaternary unit x overlying Quaternary unit y -- For example Qaf2/Qms2 in southwest corner of map.

QUATERNARY AND TERTIARY

QTaf Quaternary and/or Tertiary alluvial-fan deposits – Poorly sorted sand, silt, and gravel in fan east of Weber Canyon; fan surface is much higher than other alluvial and pediment-mantle deposits, yet retains fan shape.

QTng Quaternary and/or Tertiary gravel-armored deposits (Pleistocene and/or Pliocene) -- Often called pediment gravel; caps Fowkes Formation near Porcupine Ridge. On the west side of Durst Mountain, includes underlying alluvial-fan deposits mapped next to normal faults; previously included in Huntsville fanglomerate.

QTa Quaternary and/or Tertiary high-level alluvium – Gravel, sand, silt, and clay above numbered stream terraces, alluvium, and pediment-mantle deposits; locally gravel-armored; locally may be younger than other Quaternary-Tertiary units.

TERTIARY and marlstone locally; marker beds (labeled cm and rm, nearly equivalent at map scale) shown in upper part in northeast part of map area; lighter shades of red, yellow/tan, and light gray more common in uppermost part; total thickness up to 4,500 feet (1,370 m), thickest south of Henefer; thickness varies locally, due to considerable relief on basal erosional surface in Lost Creek drainage and along leading edge of Willard thrust.

Ty Pliocene(?) conglomerate – Only present next to normal faults on west side of Durst Mountain; unconformably overlies Norwood Tuff; previously included in Huntsville fanglomerate. Tsn Tsnc Salt Lake Formation and/or Norwood Tuff, undivided Conglomerate of Salt Lake Formation and/or Norwood Tuff, undivided Tsl Salt Lake Formation (as mapped Pliocene and Miocene, and possibly Oligocene) -- Tuff, tuffaceous siltstone and sandstone, altered tuff/claystone, and

conglomerate; estimated thickness 0-500 feet (0-150 m) in James Peak quadrangle.

Thv Fanglomerate of Huntsville area -- Age uncertain, but unconformably overlies Norwood Tuff, and part may interfinger with Norwood Tuff; mapped in the Durst Mountain area; deposits included in this map unit have seveal ages, so where possible divided into included units Qcg, QTg, and Ty. Tn Norwood Tuff (lower Oligocene and upper Eocene) -- Typically light-gray to light-brown tuff, tuffaceous siltstone and sandstone, altered tuff/claystone, and conglomerate; generally considered younger than the Fowkes, but not well dated; up to about 5,000 feet (1,525 m) thick, thickest between Morgan and Huntsville.

Tf Fowkes Formation (middle(?) Eocene) -- Typically green to gray tuff, tuffaceous siltstone and sandstone, altered tuff/claystone, and conglomerate; could be older than or the lateral equivalent of at least part of the Norwood; as mapped Bulldog Member (altered green tuff) is at base, because lowermost Fowkes(?) mostly looks like uppermost Wasatch Formation; 0 to about 500 feet (0-150 m) exposed, up to at least 2,000 feet (610 m) thick in subsurface, thickest near Utah-Wyoming state line.

Tw Wasatch Formation (Eocene and uppermost Paleocene) -- Typically red sandstone, siltstone, mudstone, and conglomerate with minor gray limestone

Twl Limestone – Gray, oncolitic limestone and light-gray to white marlstone; discontinuous, grades laterally into Tw; mapped in Monte Cristo Peak and Sharp Mountain quadrangles; 0 to 300 feet thick (0-90 m).

Twc Basal conglomerate -- Red-orange- and tan-weathering, cobble conglomerate, mainly containing Proterozoic and Cambrian quartzite clasts; mapped along western tributaries of Lost Creek and in Porcupine Ridge and Wahsatch quadrangles; 0 to 400 feet (0-120 m) thick.

Td Igneous dikes (Tertiary?) -- Strongly chloritically altered mafic dikes in Ogden 7.5' quadrangle.

TERTIARY AND CRETACEOUS Evanston Formation (Paleocene and Upper Cretaceous-Maastrichtian/Campanian) TKe Upper member(?) -- Variegated red, tan, light-gray, and light-green sandstone, siltstone, and mudstone and minor quartzite-pebble conglomerate, carbonaceous shale, and coal; about 1,000 feet (305 m) thick where exposed east of the Bear River.

Keh Hams Fork Member (Upper Cretaceous) -- Light-gray, brownish-gray, and tan sandstone, conglomeratic sandstone, and quartzite- and chert-pebble conglomerate, variegated gray, greenish-gray, and red mudstone, and dark-gray, carbonaceous shale and coal in upper part; member coarsens downward and northwestward; thickens westward from 50 to 100 feet (15-30 m) near Evanston to 300 feet (90 m) at Echo Canyon, and northward to 1,200 feet (365 m) near Lost Creek Dam; unconformably truncated and locally absent beneath Wasatch

Formation in hanging wall of the East Canyon thrust in Henefer quadrangle; thins to truncation northward above basal unconformity from Lost Creek Dam to Woodruff Creek area.

Kehc Basal conglomerate of Hams Fork Member (Upper Cretaceous) --Tan and gray, cobble to boulder conglomerate with minor interbedded gray, carbonaceous mudstone; conglomerate contains >80% Proterozoic and Cambrian quartzite clasts, but locally contains clasts of Triassic and Jurassic sandstone and rare Precambrian crystalline basement clasts; 0 to 300 feet (0-90 m) thick; conglomerate is truncated along a basal angular unconformity north of Lost Creek Dam.

WILLARD THRUST SHEET (Outer Shelf Sequence)

PERMIAN

Pp Park City and Phosphoria Formations, undivided (Permian) -- Includes (in descending order): Franson Member of Park City Formation and several thin members of both formations (Permian) - Limestone and dolomite, cherty; about 400+ feet (120+ m) thick near Causey Dam. Meade Peak Phosphatic Shale Member of Phosphoria Formation (Lower Permian) - Phosphatic limestone, dolomite, siltstone, and shale; 230 to 260 feet (70-80 m) thick near Causey Dam. Grandeur Member of Park City Formation (Lower Permian) - Limestone and dolomite; 250 to 280 feet (75-85 m) thick near Causey Dam.

PERMIAN AND PENNSYLVANIAN

PIPw Wells Formation (Lower Permian and Pennsylvanian) (at least partly equivalent to Weber Quartzite to south) – Light-gray to white, thick-bedded sandstone in upper part with interbedded, dark-gray, thick-bedded limestone and minor dolomite in lower part; about 400 feet (120 m) thick at Causey Dam.

MISSISSIPPIAN

Mmc Monroe Canyon Limestone (Mississippian-Chesterian and Meramecian) (roughly equivalent to upper Humbug interval, and possibly Doughnut elsewhere in map area) – Includes upper dolomite and limestone, and underlying limestone and minor siltstone; about 700 to 1,000 feet (210-300 m) thick in James Peak quadrangle; about 500 feet (150 m) thick at Causey Dam, but this doesn't include lower Monroe Canyon (Mml) noted below.

Mml Lower Monroe Canyon Limestone(?) - Dolomite and limestone and lesser sandstone; only mapped separately in Causey Dam quadrangle; 500 to 700 feet (150-215 m) thick; actual contact between Monroe Canyon and Little Flat Formations may be in this unit.

Mlf Little Flat Formation (Mississippian-Meramecian and Osagean)(roughly equivalent to lower Humbug and Deseret interval elsewhere in map area) – Gray, tan and reddish-tan, calcareous sandstone, and sandy limestone and dolomite, with

phosphatic shale at base; about 800 to 1,100 feet (245-335 m) thick.

Ml Lodgepole Limestone (Mississippian-Osagean and Kinderhookian) (rough equivalent of Gardison interval in Ogden Canyon) -- Dark-gray, thin-bedded, lime micrite to wackestone, locally cherty; top not exposed in Horse Ridge and Dairy Ridge quadrangles; structurally thickened in Horse Ridge quadrangle; about 750 to 900 feet (230-275 m) thick.

DEVONIAN

Dle Leatham Formation (Upper Devonian-Famennian) -- Only present in the James Peak quadrangle; poorly exposed, dark-colored siltstone and limestone; less than 30 feet (9 m) thick and truncated at unconformity.

SILURIAN AND ORDOVICIAN Map unit likely includes Cottonwood Canyon member of Lodgepole Limestone of Mississippian (Kinderhookian) age.

Db Beirdneau Sandstone (Upper Devonian) – Tan, reddish-tan, and yellowish-gray sandstone, siltstone, and sandy dolomite and limestone; contact ledge "limestone" at top; thickens southward from Monte Cristo Peak to Causey Dam, from about 245 to 500 feet (77-150 m); structurally thickened in Horse Ridge quadrangle; thins to west over Stansbury uplift and not present in Mantua, James Peak, and Sharp Mountain quadrangles.

Dhw Hyrum and Water Canyon Formations

Dh Hyrum Dolomite (Upper and Middle Devonian) – Dark-gray to medium-brownish gray, coarsely crystalline dolostone; weathers distinctive, chocolate-brown color; exposed in Causey Dam, James Peak, and Monte Cristo Peak quadrangles, and possibly exposed in Sharp Mountain quadrangle; 400 to 675 feet (120-205 m) thick; 50 to 165 feet (15-50 m) of Hyrum(?) in Mantua quadrangle and not present to north in Wellsville Mountains; thins to west over Stansbury uplift.

Dwc Water Canyon Formation (Lower Devonian) -- Thin- to medium-bedded, reddish-tan and gray siltstone and light-gray to light-tannish-gray, very light-gray- to white-weathering, very thick-bedded to thinly laminated, finely crystalline dolostone; thins southward from about 400 feet (120 m) thick near Sharp Mountain to 200 feet (60 m) thick at Causey Dam; possibly 50 to 165 feet (15-50 m) of Water Canyon(?) in Mantua quadrangle, but faulted; probably thins over Tooele arch or Stansbury uplift.

SOlf Laketown and Fish Haven Dolomites -- Dark- to light-gray, cherty dolostone; about 500 to 1,400 feet (150-425 m) thick, thins to south, probably over Tooele arch.

Sl Laketown Dolomite (as mapped Silurian and Ordovician) -- Dark- to light-gray, thick- to very thick-bedded, cherty dolostone; about 500 to 1,500 feet (150-460 m) thick, thins to south, probably over Tooele arch; mapped separately from Fish Haven Dolomite where Swan Peak Formation is present.

ORDOVICIAN

Ofs Fish Haven Dolomite and Swan Peak Formation Fish Haven Dolomite (Ordovician) -- Dark-gray, thick- to very thick-bedded dolostone with white chert as small nodules; commonly with dull-medium-gray to light-gray mottling on weathered

surfaces; forms resistant ridge where distinguishable from more recessive dolostones at the base of the overlying Laketown Dolomite; 0 to at least 165 feet (0-50 m) thick, possibly up to 380 feet (115 m) thick; thins to south and missing over Tooele arch. Swan Peak Formation (Ordovician) -- Mostly tan to pale-reddish quartzite with lower part containing similar quartzite, dark shale, and some limestone beds; 0 to about 250 feet (0-75 m) thick, thickest in northwest and north; present from Sharp Mountain westward; missing to south over Tooele arch and missing on leading edge of thrust sheet.

Ogc Garden City Formation (Ordovician) -- Dark-gray to gray, thin- to medium-bedded, silty limestone; intraformational, flat-pebble conglomerate common in lower half; weathers light bluish-gray with yellow/tan-weathering, wavy, siltstone layers; forms resistant ridges; commonly structurally thickened on leading margin of thrust sheet; usually about 400 to 1,200 feet (120-365 m) thick, thins to south and missing over Tooele arch.

ORDOVICIAN AND CAMBRIAN

Ꞓsn St. Charles and Nounan Formations

Ꞓsc St. Charles Formation (Ordovician and Upper Cambrian) -- Dark-gray, medium-to thick-bedded dolostone, weathers very dark gray with medium-gray, crude laminae and mottling; contains subordinate medium-gray, very thick- to thick-bedded dolostone; light-gray, tannish-gray weathering, thin-bedded, silty limestone present above and interbedded with basal quartzite; basal unit also contains tannish-gray, medium-bedded, cross-bedded Worm Creek quartzite (Upper Cambrian) and light-tannish-gray, silty shale; quartzite about 0 to 75 feet (0-25 m) thick; total thickness about 500 to 970 feet (150-295 m).

CAMBRIAN

Ꞓn Nounan Formation (Middle and Upper Cambrian) -- Medium-gray, very thick- to thick-bedded dolostone; with subordinate dark-gray, medium- to thick-bedded dolostone that weathers very dark gray with medium-gray, crude laminae and mottling; about 500 to 1,150 feet (150-350 m) thick, thins to south and possibly to east.

Ꞓbo Bloomington Formation (Middle Cambrian) -- Olive to tan shale and gray, nodular limestone; about 500 to 900 feet (150-275 m) thick; divided into members (descending), except in Mantua quadrangle:

Ꞓbc Calls Fort Shale Member -- Olive-gray to tan-gray, thin bedded, micaceous shale and argillite with minor, thin-bedded, dark-gray, silty limestone; 75 to 125 feet (35 to 40 m) thick on leading edge of thrust sheet.

Ꞓbm Middle limestone member -- Dark gray, thick- to thin-bedded limestone with tan-, yellow-, and red-weathering, wavy, silt layers; contains subordinate olive-gray and tan-gray, thin-bedded, micaceous shale and argillite; thickens southward from 425 to 850 feet (130-260 m) on leading edge of thrust sheet.

Ꞓbh Hodges Shale Member -- Olive-gray to tan-gray, thin-bedded, micaceous shale and argillite and thin- to thick-bedded, dark-gray limestone with tan-, yellow-, and red-weathering, wavy, silt layers; thickens southward from 410 to 600 feet (125-180 m) along leading edge of thrust sheet.

Ꞓbbu Blacksmith and Ute Formations - As mapped locally includes part of the Bloomington Formation and the Langston Dolomite; this combined unit only used in Browns Hole quadrangle.

Ꞓbl Blacksmith Dolomite (Middle Cambrian) -- Medium-gray, very thick- to thick-bedded, coarsely crystalline dolostone; forms cliffs and ridges; about 400 to 760 feet (120-230 m) thick; thickens to east and then southward on leading edge of thrust sheet.

Ꞓul Ute and Langston Formations -- This combined unit only used in the Huntsville and Mantua quadrangles; about 800 feet (245 m) thick.

Ꞓu Ute Formation (Middle Cambrian) -- Gray to dark-gray, thin- to thick- bedded limestone with tan-, yellow-, and red-weathering, wavy, silt layers, and olive-gray to tan-gray, thin-bedded, micaceous shale and argillite; and minor, medium-bedded, gray to light-gray dolostone; estimate 450 to 800 feet (140-245 m) thick; may be thinner on leading edge of thrust sheet.

Ꞓl Langston Dolomite (Middle Cambrian) -- Gray, dark-gray, and gray-brown, thin-to thick-bedded, sandy limestone and dolostone in upper part and greenish gray, red-weathering shale and tan, dolomitic sandstone in lower part; 200 to 340 feet (60-100 m) thick.

CAMBRIAN AND PROTEROZOIC

Ꞓgc, Ꞓgcu, Ꞓgcl Geertsen Canyon Quartzite (Middle and Lower Cambrian and possibly upper Proterozoic) -- In west mostly buff quartzite, with some brown-weathering argillite locally and common at top; upper part (igcu) 2,400 to 2,700 feet (730-825 m) thick; lower part (igcl) mostly arkosic, 1,640 feet (500 m) thick; total about 4,200 feet (1,280 m) thick.

Divided in east into different members.

Ꞓgu Upper member – Tan, white, and light-gray, medium- to coarse-grained, cross-bedded, thick-bedded quartzite in upper part; becomes increasingly conglomeratic and arkosic in lower part; base of member is marked by a resistant, purple-weathering, quartz-pebble conglomerate containing white and pink quartz and rare jasper clasts; about 3,200 feet (975 m) thick in Horse Ridge and Dairy Ridge quadrangles. This is likely the entire Geertsen Canyon with the Browns Hole absent and the base being the Mutual Formation.

Ꞓgl Lower member – White, fine- to coarse-grained, locally vitreous, thick-bedded quartzite in upper part; lower part contains interbeds of red and green argillite; up to 1,500 feet (460 m) thick, but base is truncated by Willard thrust in Horse Ridge and

Dairy Ridge quadrangles. This is likely the Caddy Canyon Quartzite with the Inkom absent and grading, at the base, into the Kelley Canyon Formation.

PROTEROZOIC

Zb Browns Hole Formation (upper Proterozoic) -- Upper part quartzite, 60 to 285 feet (20-85 m) thick; lower part metavolcanic rocks, 0 to 460 feet (0-140 m) thick.

Zm Mutual Formation (upper Proterozoic) -- Purplish quartzite, locally arkosic; 435 to 2,600 feet (135-790 m) thick; thins to southeast and thinnest in Browns Hole.

Zi Inkom Formation (upper Proterozoic) -- Argillite to psammite (metasandstone over metasiltstone) with basal metatuff lenses; 16 to 450 feet (5-140 m) thick, thickest near Huntsville.

Zcc Caddy Canyon Quartzite (upper Proterozoic) -- Mostly vitreous, almost white quartzite; 1,000 to 2,500 feet (305-760 m) thick, thickest near Geertsen Canyon.

Zpc Papoose Creek Formation (upper Proterozoic) -- Argillite to psammite (metasiltstone interbedded with quartzose metasandstone); only mapped in Mantua quadrangle and 750 to 1,500 feet (230-460 m) thick; lateral relations uncertain but seems to grade laterally into upper Kelley Canyon.

Zkc Kelley Canyon Formation (upper Proterozoic) -- Argillite to phyllite, with rare metacarbonate; grades into overlying Caddy Canyon quartzite with increasing quartzite near Huntsville; only 600 feet (185 m) thick in Mantua quadrangle, where Papoose Creek takes up most of this interval, but 2,000 feet (610 m) thick near Huntsville.

Zmc, Zmcc, Zmcg Maple Canyon Formation (upper Proterozoic) -- Upper (Zmcc) - Quartzite to metaconglomerate at top and bottom with thin argillite in middle, 100 to 500 feet (30-150 m) thick; Lower (Zmcg) - Green arkosic metasandstone with argillite partings and local quartzite, 500 to 1,000 feet (150-305 m) thick; 1,000 to 1,500 feet (305-460 m) total thickness.

ZYp, ZYpg, ZYpm, ZYpd, ZYpb, Zypi Formation of Perry Canyon (upper and possibly middle Proterozoic) -“Sandstone” member (ZYpg) - Metasiltstone and metasandstone with some argillite, 3,000 feet (915 m) thick; “Mudstone” member (ZYpm) - Argillite and slate, 1,650 to 3,300 feet (500-1,005 m) thick; Diamictite member (ZYpd) -Diamictite, quartzite, and granitoid clasts in sandy argillite matrix, with local metapillow lava (ZYpb) and metalimestone at and near base, 0 to 1,650 feet (0-500 m) thick; local altered intrusive diorite (ZYpi).

Xf, Xfq, Xfs, Xfd, Xfls, Xfgn Facer Formation (lower Proterozoic) -- Contains (in order of abundance): quartzite (Xfq), quartz-hematite schist (Xfq), pelitic phyllite and schist (Xfs), and quartz-muscovite schist (Xfq), with sparse metacarbonate (Xfd, Xfls) and metaarkose (Xfgn, leucocratic gneiss); estimate 2,500 feet (760 m) total thickness;

metamorphosed at same time as Farmington Canyon complex and, based on lithology, might be a lower grade assemblage of Farmington Canyon rocks.

SUB-WILLARD THRUST -- OGDEN CANYON (Transitional Shelf Sequence; some names from outer shelf sequence may not be appropriate, but are those traditionally used)

MISSISSIPPIAN

Mh Humbug Formation -- Dolomite, sandstone, and dolomitic sandstone; about 800 to 1,000 feet (245-305 m) thick.

Mde Deseret Limestone -- Dolomite and limestone, phosphatic at base; 200 to 250 feet (60-75 m) thick.

Mg Gardison Limestone -- Limestone and dolomite; ledge forming; about 300 to 850 feet (90-260 m) thick.

DEVONIAN (named on western Willard thrust sheet so names probably not appropriate)

Dbhw Beirdneau, Hyrum, and Water Canyon Formations

Db Beirdneau Sandstone -- Sandstone, siltstone, dolomitic sandstone, and dolomite; 165 to 330 feet (50-100 m) thick.

Dhw Hyrum and Water Canyon Formations --300 to 400 feet (90-120 m) thick. Hyrum Dolomite -- Dolomite and minor limestone and limy siltstone; about 200 to 350 feet (60-107 m) thick; thins over Stansbury uplift. Water Canyon Formation -- Thin-bedded sandy dolomite, siltstone and minor sandstone; slope forming; 3 to 100 feet (1-30 m) thick; thins over Stansbury uplift.

Laketown Dolomite is missing over Stansbury uplift, so missing at Ogden Canyon and to east on Crawford thrust sheet.

ORDOVICIAN (named on eastern Paris-Willard thrust sheet so names may not be appropriate)

Ofg Fish Haven and Garden City Formations (Swan Peak Formation is missing over Tooele arch, so missing at Ogden Canyon) Fish Haven Dolomite -- Dolomite; cliff forming; 130 to 265 feet (40-80 m) thick at Ogden Canyon, so not thinned here over Tooele arch. Garden City Formation -- Dolomite and sandy dolomite with siltstone partings; 200 to 330 feet (60-100 m) thick; thins over Tooele arch. ORDOVICIAN AND CAMBRIAN (named on eastern Paris-Willard thrust sheet so names may not be appropriate)

Ꞓsn St. Charles and Nounan Formations

Ꞓsc St. Charles Formation -- Dolomite; Worm Creek member at base; 330 to 660 feet (100-200 m) thick and thickens to north; thins over Tooele arch.

CAMBRIAN (Nounan and Bloomington names may not be appropriate since named on Paris-Willard thrust sheet) in Nounan Dolomite -- Dolomite; cliff forming; 330 to 825 feet (100-250 m) thick and thinning over Tooele arch.

Ꞓbm Calls Fort Shale Member of Bloomington Formation and Maxfield Limestone – Calls Fort Shale contains shale, limestone, and silty limestone; intraformational conglomerate common; 40 to 165 feet (12-50 m) thick and thickens to north; thins over Tooele arch.

Ꞓbmu Calls Fort Shale Member of Bloomington Formation and upper Maxfield Limestone

Ꞓm Maxfield Limestone (Middle Cambrian) -- Limestone and shale; total thickness about 600 to 1,150 feet (180-350 m). Where possible divided into subunits.

Ꞓmu Upper member - Mostly dolomite overlying mostly limestone, about 300 to 525 feet (90-160 m) thick. imml Middle and lower members imm Middle member- Silty limestone, with shale partings and limestone nodules, and shale, 165 to 330 feet (50-100 m) thick. iml Lower member - Limestone and possibly dolomite, 100 to 165 feet (30-50 m) thick.

Ꞓo Ophir Formation (Middle Cambrian) -- Highly deformed; total thickness about 300 to 660 feet (90-200 m). Contains: Upper shale and limestone; slope forming; thickness highly variable. Middle limestone, 15 to 165 feet (5-50 m) thick. Lower argillite and siltstone; slope forming; thickness highly variable but about 100 to 145 feet (30-45 m) thick.

Ꞓt Tintic Quartzite (Middle and Lower Cambrian) -- Quartzose, very-well-cemented, cliff-forming sandstone with lenses and beds of quartz-pebble conglomerate; arkosic lenses near base; 1,000 to about 1,500 feet (305-460 m) thick.

PROTEROZOIC

Xfc Farmington Canyon Complex (lower Proterozoic) - divided into Xfcm Migmatitic gneiss Xfch Hornblende-plagioclase gneiss -- Only found in footwall of Ogden thrust Xfcb Biotite-rich gneiss Xfcq Quartz-rich gneiss Xfcu Meta-ultramafic gneiss Xfcg Granitic gneiss Xfcs Mica-rich schist and gneiss Xfcc Chloritic gneiss, mylonite and phyllonite XJKq Quartz veins (Proterozoic, Jurassic, and/or Cretaceous) -- Quartz veins and pods of uncertain age generally associated with hydrothermally altered chloritic gneiss (Xfcc). Xa Amphibolite (intrusive?)

CRAWFORD AND OTHER THRUST SHEETS -- Durst Mountain and Lost Creek areas, and terrain to the east (Exposed Paleozoic rocks are part of Transitional Shelf Sequence)

CRETACEOUS

Kwc Weber Canyon Conglomerate (Upper Cretaceous-Campanian/late Santonian) Red,

gray and tan, boulder to cobble conglomerate with minor sandstone and mudstone interbeds; exposed above the buried Crawford thrust trace in Lost Creek drainage and along the Right Fork of South Ogden River east of Causey Dam; clasts are from the Tintic Quartzite, Weber Quartzite, Nugget Sandstone, Lodgepole Limestone, Park City Formation, and Twin Creek Limestone; contains progressive intraformational unconformities; at least 1,900 feet (580 m) thick near Devils Slide and forms cliffs.

Echo Canyon Conglomerate (Upper Cretaceous-Santonian/Coniacian)
Keu Upper member -- Red, massively bedded, pebble to boulder conglomerate, minor gray and tan sandstone and gray mudstone; conglomerate clasts are dominated by sandstone and quartzite derived from Jurassic, Triassic, and upper Paleozoic strata of the Durst Mountain block above the Crawford thrust; 790 feet (240 m) thick in Echo Canyon.

Kel Lower member -- Light gray and tan pebble to boulder conglomerate, light-gray to tan sandstone and pebbly sandstone, and minor varicolored mudstone; conglomerate clasts include sandstone and quartzite from Jurassic and upper Paleozoic formations, up to 20% limestone clasts mainly derived from

Mississippian strata, as well as distinctive Cambrian and Proterozoic quartzites of the Willard thrust sheet; 950 feet (290 m) thick in Echo Canyon.

Khen Henefer Formation (Upper Cretaceous-Coniacian/Turonian?) -- Tan and gray, coarse-grained to conglomeratic sandstone, cyclically interbedded with gray mudstone, shale, and carbonaceous mudstone; coarsens upward and westward; dominantly massive, yellow-weathering, bioturbated sandstone in upper Echo Canyon; up to 2,500 feet (760 m) thick.

Kf Frontier Formation (Upper Cretaceous-Turonian/Cenomanian), where possible divided into:

Kfu Upper member – Gray to yellowish-gray, calcareous, fine-grained sandstone interbedded with gray, calcareous shale; mapped east of Henefer; probably lateral equivalent of Upton Sandstone, Judd Shale, Meadow Creek Sandstone, and, possibly, the upper part of the Dry Hollow Members of the Coalville area; about 1,100 feet (335 m) thick near Henefer.

Kfup Upton Sandstone – Gray to yellowish-gray, calcareous, fine-grained sandstone; 221 feet (67 m) thick in the Huff Creek area, Castle Rock quadrangle.

Kfj Judd Shale – Gray, calcareous shale; poorly exposed; about 225 feet (70 m) thick in the Huff Creek area, Castle Rock quadrangle.

Kfm Meadow Creek Sandstone – Light-yellowish-gray, calcareous, fine-grained, cross-bedded sandstone; about 285 feet (87 m) thick in the Huff Creek area, Castle Rock

quadrangle.

Kfg Grass Creek Member -- Gray calcareous shale; poorly exposed; about 235 feet (72 m) thick in the Huff Creek area, Castle Rock quadrangle.

Kfd Dry Hollow Member -- Tan and reddish-gray, very thick-bedded, cobble conglomerate east of Henefer; conglomerate includes clasts of Cambrian(?) and Upper Paleozoic quartzite, Mississippian limestone, Mesozoic sandstone and siltstone, and chert; conglomerate zone thickens markedly northward from 520 feet (160 m) at Bald Rock Canyon to over 1,200 feet (365 m) in Harris Canyon. In Huff Creek area, Castle Rock quadrangle, member contains light-yellowish-gray, fine-grained, calcareous sandstone in upper 70 feet (21 m); gray-brown and tan, calcareous siltstone and shale in middle part; and contains interbedded lenses of light-gray, coarse-grained sandstone and chert- and quartzite-pebble conglomerate in lower 100 feet (30 m); total thickness in Huff Creek area is about 550 feet (168 m).

Kfo Oyster Ridge Sandstone – Light-yellow- to orange-gray, fine-grained, calcareous sandstone with local pebble layers and disarticulated pelecypod shells; thins northward in the Henefer area from 260 to140 feet (80-43 m); about 80 feet (25 m) thick along Huff Creek, Castle Rock quadrangle.

Kfac Allen Hollow and Coalville Members – Gray, calcareous shale in upper part; and medium-bedded, light-yellow-gray, calcareous sandstone with interbedded carbonaceous shale and coal in lower part; poorly exposed; 550 to 625 feet (168 - 190 m) thick where exposed near Henefer.

Kfa Allen Hollow Member – Gray calcareous shale; poorly exposed; about 780 feet (240 m) thick along Huff Creek.

Kfc Coalville Member – Yellow-gray calcareous sandstone with interbedded carbonaceous shale and coal; about 225 feet (70 m) thick along Huff Creek, Castle Rock quadrangle.

Kfcc Chalk Creek Member - Red and tan-gray, very thick-bedded, cobble conglomerate east of Henefer; conglomerate includes clasts of Cambrian(?) and Upper Paleozoic quartzite, Mississippian limestone, Mesozoic sandstone and siltstone, and chert; conglomerate thickens markedly northward from 460 (140 m) feet thick at Bald Rock Canyon to about 1,960 feet (600 m) thick in Harris Canyon. In Huff Creek area, Castle Rock quadrangle, member contains gray to red, coarse-grained, medium-bedded sandstone with discontinuous chert- and quartzite-pebble conglomerate lenses; interbedded with red, tan, and gray mudstone and siltstone; base not exposed along Huff Creek; 3,150 feet (960 m) thick to south at Coalville.

Kfl Lower member – Gray to red, coarse-grained, medium-bedded sandstone with discontinuous chert- and quartzite-pebble conglomerate beds; interbedded with red, tan, and gray mudstone and siltstone; some yellowish-gray, fine-grained, calcareous sandstone and gray, calcareous siltstone in lower part; equivalent to

lower Chalk Creek, Spring Canyon, and Longwall Sandstone members of the Coalville area; about 850 feet (260 m) thick near Henefer; basal 250 feet (75 m) mapped above Aspen Shale on southeast flank of Porcupine Ridge.

Ka Aspen Shale (Albian) – Dark-gray, fissile, siliceous shale and silty shale with teleost fish scales; about 300 feet (90 m) thick where exposed on southeast flank of Porcupine Ridge.

Kbr Bear River Formation (Albian) -- Gray, medium- to coarse-grained, calcareous sandstone; black, fossiliferous, carbonaceous shale; and gray to gray-brown, gastropod and pelecypod, limestone coquina; limited extent in subsurface and only exposed east of Bear River; 0 to 1,300 feet (0-395 m) thick, and possibly as much as 3,000 feet (915 m) thick in the subsurface.

Kk Kelvin Formation (Lower Cretaceous-Albian/Aptian) -- Near Devils Slide - upper part mainly light-gray, tan, and light-reddish-gray, coarse-grained sandstone interbedded with gray, tan, and minor red mudstone and siltstone. Lower third dominantly red-weathering, with red and tan mudstone and siltstone; thin, discontinuous, gray and lavender nodular limestone; gray and red, coarse-grained, pebbly sandstone, with reddish-gray, chert-pebble conglomerate toward base; at least 5,700 feet (1,740 m) thick, but base not exposed. Members are mapped in eastern part of map area.

Kku Upper member -- Brown, gray, and minor reddish-gray, coarse-grained sandstone and pebbly sandstone; interbedded with gray, green, and tan mudstone; partly correlative to Bear River Formation; about 1,500 feet (460 m) thick along Porcupine Ridge.

Kkc Conglomerate member - Red and reddish-gray, pebble to cobble conglomerate with interbedded red mudstone and tan-gray sandstone; top is marked by a distinctive 10-foot (3-m)-thick zone of limestone-pebble conglomerate with sutured clast boundaries; about 1,500 feet (460 m) in Porcupine Ridge area, but base not exposed.

Kg Gannett Group (Cretaceous and(?) Jurassic) -- Upper part - Gray mudstone with brownish-weathering sandstone; lower part - Red, pink, and green mudstone with brownish-weathering sandstone; only exposed near Woodruff Narrows Reservoir; 400 to 500 feet (120-150 m) thickness exposed; subsurface thickness up to 3,400 feet (1,035 m).

JURASSIC

Jsp Stump and Preuss Formations – (Upper and Middle Jurassic) -- Poorly exposed; about 800 feet (245 m) thick at Toone Canyon; subsurface thickness up to 1,500 feet (460 m) with an additional 0 to 1,200 feet (0-365 m) of salt at base.

Js Stump Sandstone (Upper and Middle Jurassic) -- Pale red, yellow, gray, and green-gray shale and calcareous sandstone, locally glauconitic; 60 to 420 feet (20-130 m) thick, thinning northward.

Jp Preuss Redbeds (Middle Jurassic) -- Red and purple-red sandstone, siltstone, and shale, with halite near base in subsurface; mapped separately at the head of Lost Creek and along the East Canyon fault zone.

Twin Creek Limestone (Middle Jurassic)

Jtgc Giraffe Creek Member -- Gray, greenish-gray and tannish-gray, calcareous sandstone, lime grainstone, with intraformational conglomerate in Woodruff Creek area; structurally thickened in synclinal hinges between Lost Creek Dam and Woodruff Creek; 108 to 225 feet (35-70 m) thick.

Jtl Leeds Creek Member -- Light-gray, thin- to very thick-bedded, soft, clay-rich, micritic limestone with tan, silt partings; locally exhibits bedding-normal, pencil cleavage; forms barren, scree-covered slopes; 1,000 to 1,300 feet (300-395 m) thick.

Jtw Watton Canyon Member -- Dark-gray, lime micrite and wackestone and minor oolite packstone; forms prominent ridges; locally exhibits bedding-normal, stylolitic, spaced cleavage; about 400 feet (120 m) thick.

Jtb Boundary Ridge Member -- Gray, very thick-bedded, ridge-forming, oolitic, lime grainstone to wackestone beds in middle and upper part that separate red and purple siltstone and gray, silty limestone beds in middle and lower part; 100 to 250 feet (30-75 m) thick.
Jtr Rich Member -- Light-gray, thin- to very thick-bedded, soft, clay-rich,micritic limestone in upper part and gray lime wackestone in lower part; locally exhibits bedding-normal, pencil cleavage; forms barren, scree-covered slopes; about 425 to 540 feet (130-165 m) thick.

Jts Sliderock Member -- Dark-gray, very thick-bedded, lime wackestone in upper part and dark-gray, pelecypod and crinoid grainstone in lower part; forms small ridges; 100 to 227 feet (30-70 m) thick.

Jtgs Gypsum Spring Member -- Red siltstone and sandstone, and gray, vuggy dolomite, with anhydrite in subsurface; up to 208 feet (65 m) thick.

Jn Nugget Formation (Lower Jurassic) -- Pale-grayish-orange, pinkish, and locally white, well-cemented, cross-bedded, quartz sandstone with frosted sand grains; from 1,100 to 1,500 feet (305-460 m) thick.

TRIASSIC

T_{Ra} Ankareh Formation, Higham Grit, and Timothy Sandstone and Portneauf Limestone Members of Thaynes Formation, undivided (Triassic) – Mixture of shale, siltstone, sandstone, and limestone; 1,100 feet (335 m) exposed thickness at Devils Slide; subsurface thickness 750 to 1,100 feet (230-335 m); structurally thinned where exposed near leading edge of Willard thrust; subdivided in Francis Canyon and Devils Slide quadrangles.

T_{R}aw Wood Shale Tongue of the Ankareh Formation (Triassic) -- Bright orange-red shale, siltstone and sandstone; locally micaceous; 515 feet (155 m) exposed near Devils Slide. T_{R}ht Higham Grit; and Timothy Sandstone and Portneuf Limestone Members

of the Thaynes Formation (Triassic) -- Gray and greenish-gray, micaceous, quartz-granule sandstone at top; greenish-gray, lithic-pebble conglomerate with green siltstone clasts and wood fragments in middle; and locally gray and lavender, mottled limestone at base; 43 to 200 feet (15-60 m) thick.

$T_R$al Lanes Tongue of the Ankareh Formation (Triassic) -- Purple and brownish-red shale, siltstone, and sandstone; 465 feet (140 m) exposed near Devils Slide.

T_{Rt} Thaynes Formation (Lower Triassic) -- Calcareous siltstone and limestone in upper and lower part, separated by resistant limestone ridge; 2,200 feet (670 m) exposed thickness at Devils Slide; subsurface thickness 700 to 1,650 feet (215500 m); subdivided in Francis Canyon and Devils Slide quadrangles.

$T_R$tu Upper member – Brownish-gray, thin-bedded, calcareous siltstone and thin-bedded, gray, fossiliferous limestone; about 750 feet (260 m) thick.

$T_R$tm Middle member – Gray, thin-bedded, calcareous, silty shale in upper half; gray, thick- to medium-bedded, fossiliferous, ridge-forming limestone in lower half; about 210 feet (63 m) thick.

$T_R$tl Lower member -- Gray to brownish-gray, thin-bedded, calcareous siltstone to silty shale in upper part; gray to grayish-brown, thick- to thin-bedded, fossiliferous limestone in lower part; about 575 feet (175 m) thick.

$T_R$wd Woodside and Dinwoody Formations (Lower Triassic)-- Dark-red, sandy shale and siltstone and greenish-gray calcareous siltstone and silty limestone; about 1,000 feet (305 m) thick; structurally thinned where exposed near leading edge of Willard thrust sheet in Dairy Ridge quadrangle; divided in Devils Slide quadrangle.

T_RW Woodside Formation -- Dark-red, sandy shale and siltstone, with some sandstone; 800 feet (245 m) exposed thickness; 550 to 800 feet (170-245 m) thick in subsurface.

T_Rd Dinwoody Formation -- Greenish-gray and tan, calcareous siltstone and silty limestone; 500 feet (150 m) exposed thickness; 200 to 250 feet (60-75 m) thick in subsurface.

PERMIAN

Pp Park City and Phosphoria Formations, undivided – Total thickness 857 and 675 feet (260 and 205 m) and Devils Slide and Durst Mountain, respectively; divided into subunits south of Weber River in Devils Slide quadrangle.

Ppf Franson Member of Park City and Rex Chert Member of the Phosphoria Formation -- Interbedded gray to pinkish-gray to dark-gray, vuggy, cherty limestone, with lesser gray shale and calcareous sandstone, and dark-gray and black, bedded chert; about 240 to 300 feet (75-90 m) thick.

Ppm Meade Peak Phosphatic Shale Member of the Phosphoria Formation -- Gray limestone, dark-gray to black, phosphatic siltstone and shale, and gray, calcareous sandstone; 170 to 300 feet (50-90 m) thick.

Ppg Grandeur Member of Park City Formation – Light-gray, thick-bedded, dolomitic sandstone with gray chert nodules; about 220 to 312 feet (65-95 m) thick.

PERMIAN AND PENNSYLVANIAN

PIPw Wells Formation (Lower Permian and Pennsylvanian) -- Light-gray to tannish-gray, very thick-bedded, cross-bedded, fine-grained sandstone; about 1,050 feet (320 m) thick, but the base of the Wells is truncated by the Willard thrust. Present in Dairy Ridge quadrangle below leading edge of Willard thrust sheet.

IPw, IPwu, IPwl Weber Quartzite (Lower Permian and Pennsylvanian) (at least partial equivalent of Wells to north and east) -- Gray, indurated, quartzose sandstone with dolomite and siltstone in lower part; 2,500 to 3,000 feet (760-915 m) thick; divided into upper (IPwu) and lower (IPwl) parts at Durst Mountain.

PENNSYLVANIAN

IPm Morgan Formation (Pennsylvanian) (possibly equivalent to lower part of Wells Formation to north) -- Sandstone, siltstone and limestone that grades northward into lower part of Weber Quartzite; 0 to 1,000 feet (0-305 m) thick in Morgan quadrangle.

IPr Round Valley Limestone (Pennsylvanian and possibly Mississippian) (possibly equivalent to lowest Wells Formation to north) -- Mostly light-gray, fine-grained limestone; about 400 feet (120 m) thick in Morgan quadrangle.

MISSISSIPPIAN

Mdo, Mdu, Mdl Doughnut Formation (Mississippian) (possibly equivalent to upper Monroe Canyon to north; unconformity to east) -- Upper (Mdu) - Limestone and siltstone, about 290 feet (90 m) thick at Durst Mountain. Lower (Mdl) - Siltstone, shale, and limestone, 100 to 200 feet (30-60 m) thick at Durst Mountain.

Mmc Monroe Canyon Limestone (Mississippian-Chesterian and Meramecian) -- Tannish-gray, fossiliferous, vuggy, sandy dolostone; incomplete section about 1,200 feet (365 m) thick in Horse Ridge quadrangle, top not exposed.

Mh, Mhu, Mhl Humbug Formation (Mississippian) (unconformity to east; roughly equivalent to lower Monroe Canyon Limestone and upper Little Flat Formation to north) -Upper (Mhu) - Limestone with sandstone beds near base, about 300 to 350 feet (90-105 m) thick at Durst Mountain. Lower (Mhl) - Sandstone with limestone and dolomite interbeds, about 400 to 600 feet (120-185 m) thick at Durst Mountain.

Mlf Little Flat Formation (Mississippian-Meramecian and Osagean) -- White to light-tan, light-orange to tan weathering, fine-grained, calcareous sandstone; 970 feet (295 m) thick in Horse Ridge quadrangle.

Mde Deseret Limestone (Mississippian) (probably equivalent to most of Little Flat Formation to north) -- Limestone, dolomite and sandstone, with phosphatic shale at base; about 500 feet (150 m) thick at Durst Mountain; not present in Horse Ridge quadrangle.

Ml Lodgepole Limestone (Mississippian-Osagean and Kinderhookian)(roughly

equivalent to Gardison in Ogden Canyon) -- Dark-gray, thin-bedded, lime micrite to wackestone, locally cherty; about 650 to 800 feet (200-245 m) thick, but structurally thickened in Horse Ridge quadrangle.

DEVONIAN (Beirdneau, Hyrum, and Water Canyon names are from Willard thrust sheet and are probably not appropriate, but traditionally have been used)

Db Beirdneau Sandstone (Upper Devonian) -- Tan, reddish-tan, and yellowish-gray, calcareous sandstone, siltstone, and sandy dolostone and limestone; about 175 to 400 feet (55-120 m) thick; one bed of brownish-gray dolostone resembling Hyrum Dolomite in middle part in Horse Ridge quadrangle.

Dhw Hyrum and Water Canyon Formations

Dh Hyrum Dolomite (Upper and Middle Devonian) -- Dark- to medium-brownish-gray and gray, medium-bedded, coarsely crystalline dolostone; weathers distinctive, dark-chocolate brown; about 136 to 200 feet (40-60 m) thick at Durst Mountain; but, 725 feet (220 m) thick and base not exposed in Horse Ridge quadrangle, so may include Water Canyon Formation.

Dwc Water Canyon Formation -- Interbedded calcareous sandstone and sandy dolomite(?); estimated thickness 300 to 400 feet (90-120 m) at Durst Mountain.

Silurian and Ordovician missing, along with part of Cambrian (“St. Charles”), in these quadrangles due to thinning over Tooele arch.

CAMBRIAN (exposed in Durst Mountain and Morgan quadrangles)

Ꞓn Nounan Formation -- Medium-dark-gray, thick-bedded dolomite(?); estimated thickness 300 to 400 feet (90-120 m).

Ꞓm Maxfield Limestone -- Limestone and calcareous siltstone; estimated thickness 600 feet (180 m); Calls Fort Shale Member of Bloomington Formation is not present in Morgan and Durst Mountain quadrangles.

Ꞓo Ophir Formation -- Upper slope-forming brown-weathering shale; middle, ledge-forming, gray limestone; and lower brown-weathering, olive-gray shale with lesser limestone and siltstone, and mainly siltstone and sandstone in lower 60 feet (20 m); estimated total thickness 200 to 400 feet (60-120 m) thick.

Ꞓt Tintic Quartzite -- Tan quartzite, conglomeratic in lower half with Precambrian quartzite pebbles and cobbles; basal 50 to 100 feet (15-30 m) arkosic conglomerate of Farmington Canyon complex material; about 800 to 1,500 feet (245-460 m) thick.

PROTEROZOIC

Xfcs Farmington Canyon Complex -- Muscovite schist at Durst Mountain; contains pods of amphibolite and pegmatite.

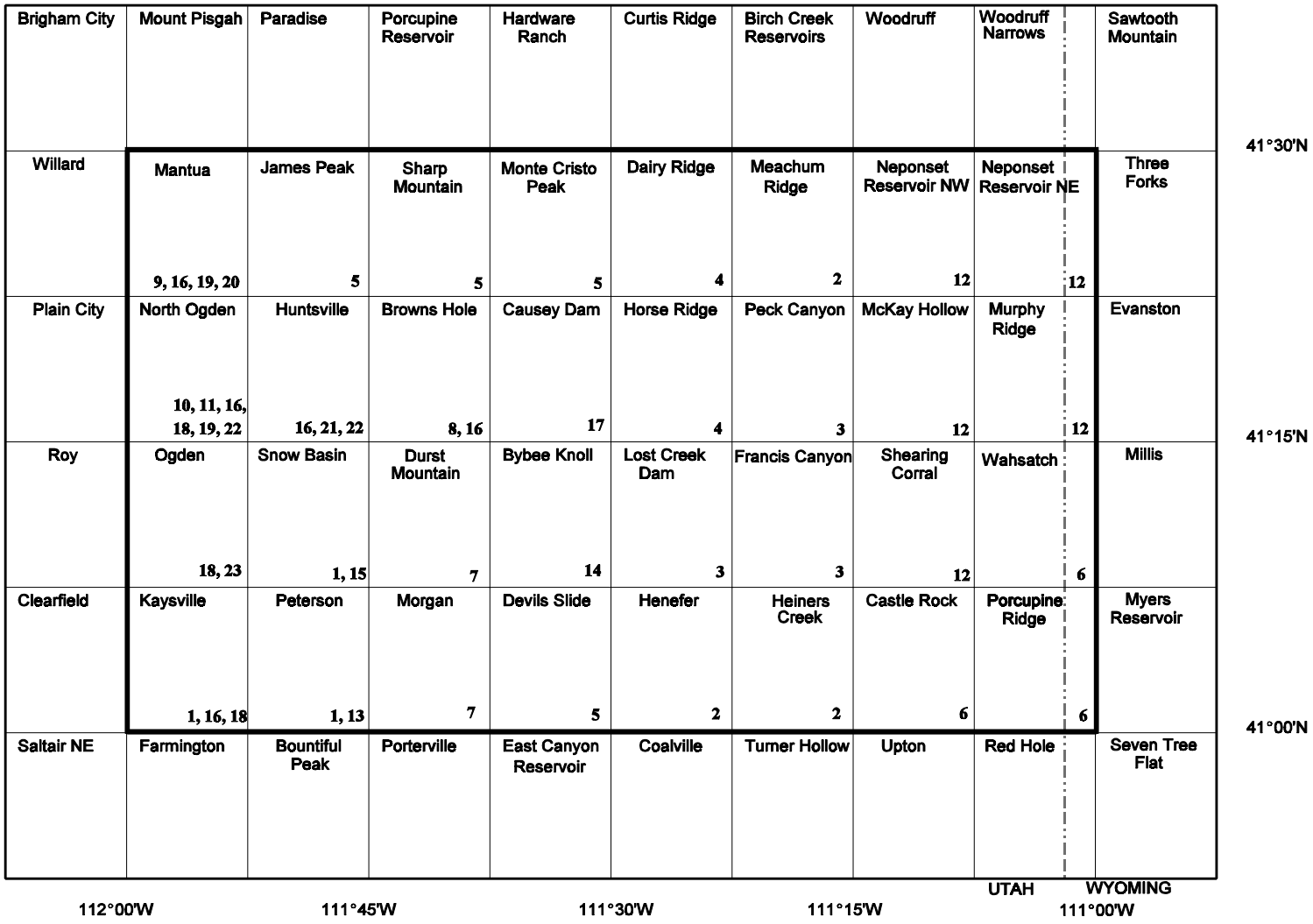
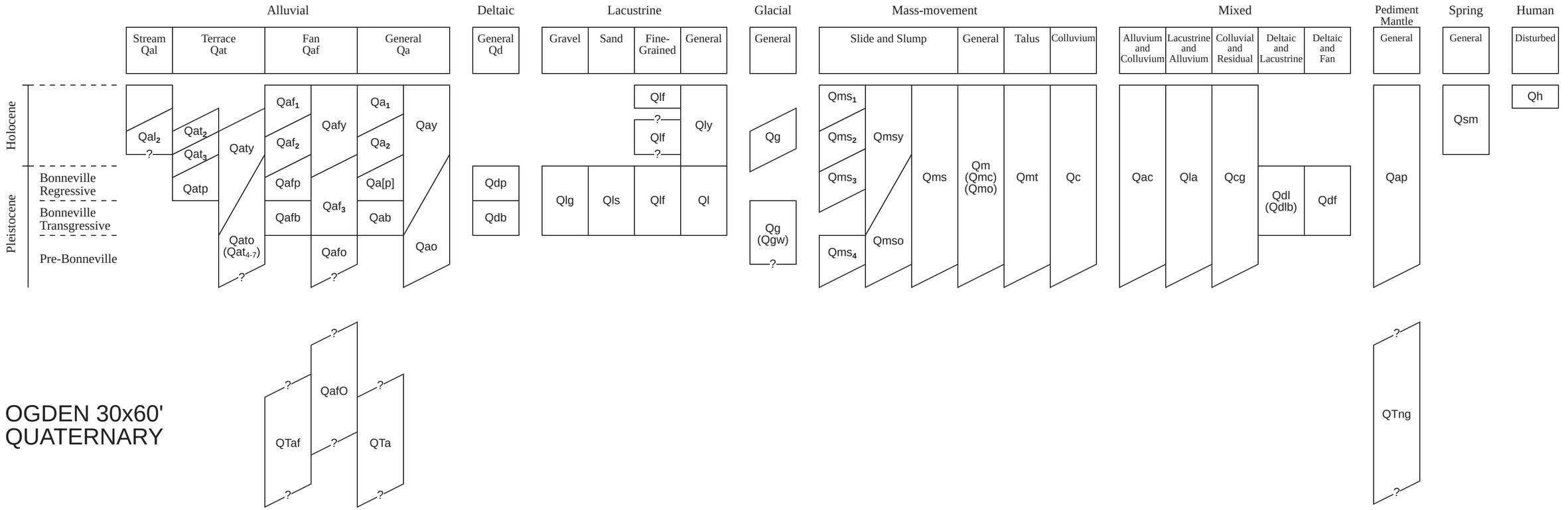
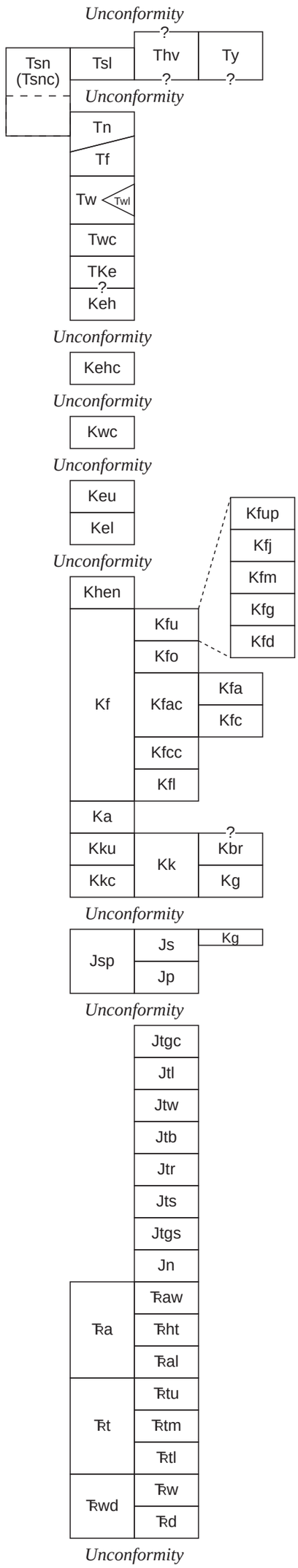


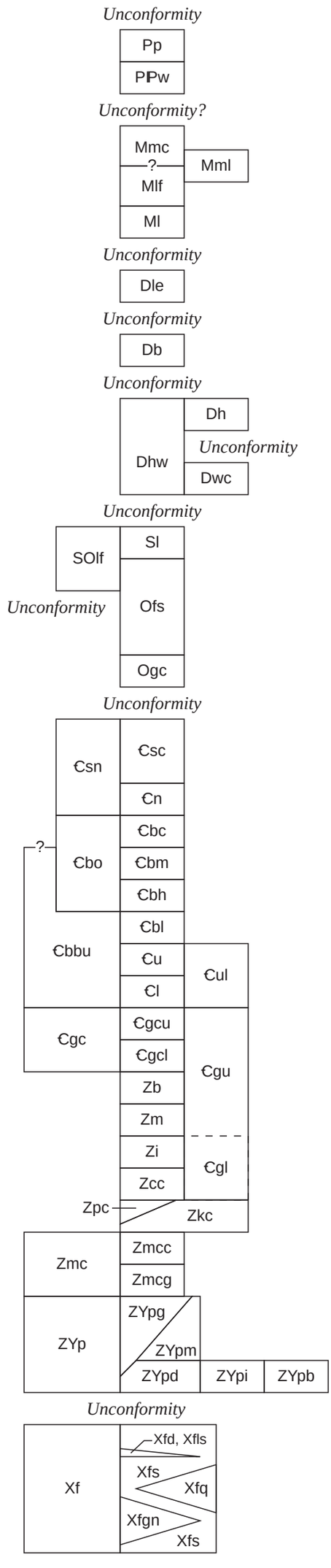
Figure 1. Index to geologic mapping, year 3.



OGDEN 30x60' QUATERNARY

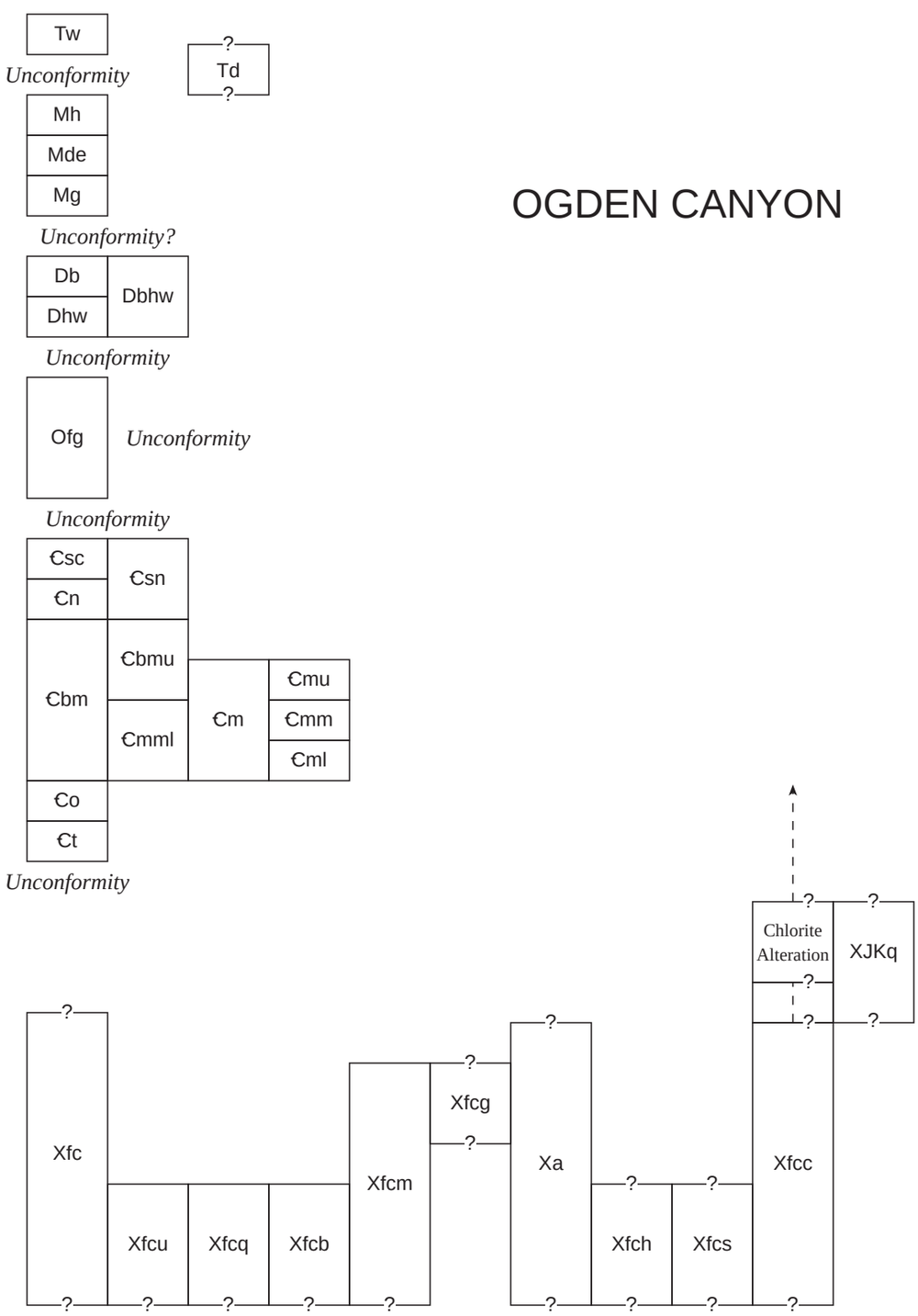


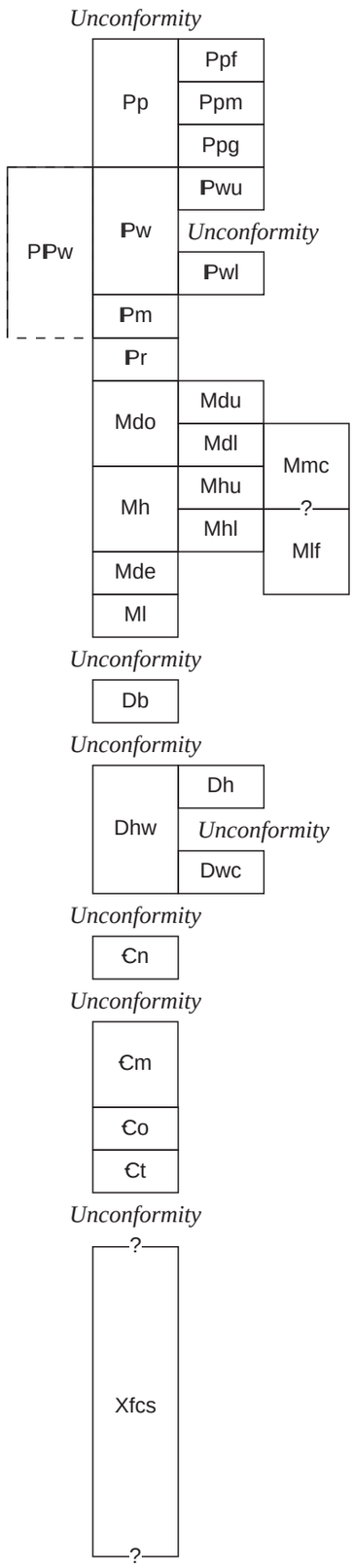
TERTIARY AND MESOZOIC



WILLARD THRUST SHEET

OGDEN CANYON

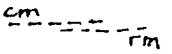




CRAWFORD and OTHER THRUST SHEETS

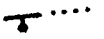
OGDEN 30' x 60' PRELIMINARY MAP SYMBOLS

Contact, dashed where approximately located or gradational, dotted where concealed



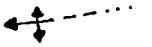
Marker Bed, shown in upper Wasatch Formation in northeast part of quadrangle

Fault, dashed where approximately located, dotted where concealed, sense of movement unknown

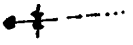


Normal Fault, bar and ball on downthrown side, dotted where concealed

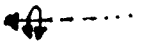
Thrust Fault, teeth on upper plate, dotted where concealed



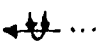
Anticline Axis, dashed where approximately located, arrow shows plunge, dotted where concealed



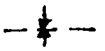
Syncline Axis, dashed where approximately located, arrow shows plunge, dotted where concealed



Overturned Anticline Axis, arrow shows plunge, dashed where approximately located, dotted where concealed



Overturned Syncline Axis, arrow shows plunge, dotted where concealed

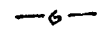


Broad Syncline Axis, approximately located

Monocline (flexure)

Overturned Monocline

Younger Shorelines in Great Salt Lake Basin



Gilbert

4217 (4,217 feet [1,286 m])

historic highstand

Lake Bonneville Shorelines

Bonneville

Provo

regressional

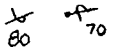
Mass-Movement Scarp

Moraine Ridge

Sinkhole

Strike and Dip of Bedding

Upright (top known on right)



Overturned (top known on right)

Vertical

Horizontal

Determined by Photogrammetry (upright)

WILLARD THRUST SHEET

AGE	MAP SYMBOL	MAP UNIT		THICKNESS FEET	THICKNESS METERS	SCHEMATIC COLUMN	OTHER INFORMATION
Q.	Q- various	Alluvial and lake deposits		0-500	0-150		
TERT.	Tsl	Salt Lake Formation		0-500	0-150		ANGULAR UNCONFORMITY
TERT.	Tn	Norwood Tuff		0-1,100	0-335		37.5 Ma K-Ar
CRET.	Tw	Wasatch Formation		0-3,400	0-1,035		Twl - limestone
PERM.	Pp	Franson Member, Park City Formation		400+	120+		MAJOR UNCONFORMITY Includes Rex Chert, Retort Shale
PERM.	Pp	Meade Peak Member, Phosphoria Fm		230-260	70-80		Phosphate
PERM.	Pp	Grandeur Member, Park City Formation		250-280	75-85		
IP.	PIPw	Wells Formation		400	120		UNCONFORMITY?
MISS.	Mmc	Monroe Canyon Limestone		700-1,000	210-305		Mml - Lower Monroe Canyon
MISS.	Mlf	Little Flat Formation		800-1,100	245-335		Delle Phosphate Member
MISS.	Ml	Lodgepole Limestone		750-900	230-275		Fossiliferous
DEV.	Db	Beirdneau Sandstone		0-500	0-150		Dle - Leatham Formation Absent to west
DEV.	Dh	Hyrum Dolomite		50-675	15-205		Thins to west
DEV.	Dwc	Water Canyon Formation		50-400	15-120		Thins to west and south
S.	SOlf Sl	Laketown Dolomite		500-1,500	150-460		Thins to south
ORD.	SOlf Ofs	Fish Haven Dolomite		0-165+	0-50+		Absent to south
ORD.	SOlf Ofs	Swan Peak Formation		0-250	0-75		Absent to south and east
ORD.	Ogc	Garden City Formation		400-1,200	120-365		Thins to south Intraformational conglomerate
CAMBRIAN	Ꞓsc	St. Ch. Formation		500-970	150-295		Worm Creek quartzite
CAMBRIAN	Ꞓn	Nounan Formation		500-1,150	150-350		Thins to south
CAMBRIAN	Ꞓbo Ꞓbc	Bloomington Formation	Calls Fort Shale Member	75-125	35-40		Intraformational conglomerate
CAMBRIAN	Ꞓbo Ꞓbm	Bloomington Formation	Middle limestone member	425-850	130-260		Thins to north
CAMBRIAN	Ꞓbo Ꞓbh	Bloomington Formation	Hodges Shale Member	410-600	125-180		
CAMBRIAN	Ꞓbl	Blacksmith Dolomite		400-800	120-245		Limestone in places
CAMBRIAN	Ꞓu	Ute Formation		450-800	140-245		
CAMBRIAN	Ꞓl	Langston Dolomite		200-300	60-90		
CAMBRIAN	Ꞓgc	Bingham Group	Geertsen Canyon Quartzite	3,000-4,200	915-1,280		
PROTEROZOIC	Zb	Bingham Group	Browns Hole Formation, Quartzite member	0-285	0-85		
PROTEROZOIC	Zb	Bingham Group	Browns Hole Formation, Volcanic member	0-460	0-140		590 Ma basaltic andesite
PROTEROZOIC	Zm	Bingham Group	Mutual Formation	435-2,600	135-790		Purple to pink Cross bedded Some feldspar locally
PROTEROZOIC	Zi	Bingham Group	Inkom Formation	0-450	0-140		Meta-tuff lenses
PROTEROZOIC	Zcc	Bingham Group	Caddy Canyon Quartzite	1,000-2,500	305-760		
PROTEROZOIC	Zpc	Papoose Creek Formation		0-1,500	0-460		Olive meta-siltstone Zpc seems to grade laterally into upper Zkc
PROTEROZOIC	Zkc	Kelley Canyon Formation		600-2,000	185-640		Argillitic to phyllitic
PROTEROZOIC	Zmc Zmcc	Maple Canyon Formation	Conglomerate member	100-500	30-150		
PROTEROZOIC	Zmc Zmcg	Maple Canyon Formation	Green arkose member	500-1,000	150-305		Thin limestone locally
PROTEROZOIC	ZYp ZYpg	Formation of Perry Canyon	"Sandstone" member	3,000	915		
PROTEROZOIC	ZYp ZYpm	Formation of Perry Canyon	"Mudstone" member	1,650-3,300	500-1,005		
PROTEROZOIC	ZYp ZYpd	Formation of Perry Canyon	Diamictite member	0-1,650	0-500		Mixed conglomerate, shale, and sandstone Glacial
PROTEROZOIC	Xf	Facer Formation		est 2,500	est 760		Varicolored quartzite and schist
							WILLARD THRUST

Diagram is schematic--- no fixed thickness scale

SUB-WILLARD THRUST -- OGDEN CANYON

AGE	MAP SYMBOL	MAP UNIT	THICKNESS FEET	THICKNESS METERS	SCHEMATIC COLUMN	OTHER INFORMATION
						MAJOR UNCONFORMITY
MISSISSIPPIAN	Mh	Humbug Formation	800-1,000	245-305		
	Mde	Deseret Limestone	200-250	60-75		Basal phosphorite
	Mg	Gardison Limestone	300-850	90-260		
DEV.	Db	Bierdneau Sandstone	165-330	50-100		UNCONFORMITY?
	Dhw	Hyrum Dolomite	200-350	60-107		
		Water Canyon Formation	3-100	1-30		UNCONFORMITY
ORD.	Ofg	Fish Haven Dolomite	130-265	40-80		UNCONFORMITY
		Garden City Formation	200-330	60-100		UNCONFORMITY
CAMBRIAN	Csc	St. Charles Formation	330-800	100-245		UNCONFORMITY
	Cn	Nounan Dolomite	330-825	100-250		Worm Creek quartzite
	Cbm	Calls Fort Member, Bloomington Formation	40-300	12-90		Intraformational conglomerate
	Cm	Maxfield Limestone	600-1,150	180-350		Boundstone
	Co	Ophir Formation	300-660	90-200		*Elrathia* *Ehmaniella* *Glossopleura*
	Ct	Tintic Quartzite	1,000-1,500	305-460		
						MAJOR UNCONFORMITY
EARLY PROTER.	Xfc	Farmington Canyon Complex	indeterminable			1,790 Ma Gneiss

Diagram is schematic--- no fixed thickness scale

CRAWFORD AND OTHER THRUST SHEETS

AGE	MAP SYMBOL	MAP UNIT	THICKNESS FEET	THICKNESS METERS	SCHEMATIC COLUMN	OTHER INFORMATION
Q.	Q-various	Alluvium, lake beds, mass movements	0-500	0-150		
TERTIARY P.	QT	Alluvium, gravel	0-1,000	0-305		
PALEOCENE-EOCENE	Tn, Tf	Norwood Tuff, Fowkes Formation	up to 5,000	up to 1,525		Altered tuff *Protoreodon* 37.5 Ma K-Ar
	Tw	Wasatch Formation	up to 4,500	up to 1,370		Twc - basal conglomerate
	TKe	Evanston Formation	0-1,000	0-305		
CRETACEOUS	Keh	Hams Fork Member of Evanston Formation	0-1,200	0-365		
	Kwc	Weber Canyon Conglomerate	0-1,900	0-580		
	Keu	Echo Canyon Conglomerate, Upper	0-790	0-240		
	Kel	Echo Canyon Conglomerate, Lower	0-950	0-290		ANGULAR UNCONFORMITY
	Khen	Henefer Formation	up to 2,500	up to 760		
	Kf Kfu	Frontier Formation, upper part	up to 7,500	up to 2,285		Upton Sandstone Judd Shale Meadow Creek Sandstone Grass Creek Member Dry Hollow Member
	Kf Kfo	Oyster Ridge Member				
	Kf	Frontier Formation, lower part				Allen Hollow and Coalville Members Chalk Creek Member lower member
	Ka	Aspen Shale	0-300	0-90		
	Kk	Kelvin Formation	3,000+	915+		Bear River Formation (Kbr) and Gannet Group (Kg) in northeast
JURASSIC	Js	Stump Sandstone	60-420	20-130		UNCONFORMITY
	Jp	Preuss Sandstone	400-1,500	120-460		Salt in subsurface
	Jtgc	Twin Creek Limestone (Jtc) Giraffe Creek Member	110-225	35-70		UNCONFORMITY
	Jtl	Twin Creek Limestone (Jtc) Leeds Creek Member	1,000-1,300	300-395		
	Jtw	Twin Creek Limestone (Jtc) Watton Canyon Member	400	120		
	Jtb	Twin Creek Limestone (Jtc) Boundary Ridge Member	100-250	30-75		
	Jtr	Twin Creek Limestone (Jtc) Rich Member	425-540	130-165		
	Jts	Twin Creek Limestone (Jtc) Sliderock Member	100-230	30-70		
	Jtgs	Twin Creek Limestone (Jtc) Gypsum Spring Member	50?-210	15?-65		
	Jn	Nugget Sandstone	1,100-1,500	305-460		
?	Traw	Wood Shale Tongue of Ankareh Fm	515	155		Chinle equivalent
TRIASSIC	Trht	Hingham Grit, and Mbrs of Thaynes Fm	43-200	15-60		
	Tral	Lanes Shale Tongue of Ankareh Fm	465	140		
	Trt	Thaynes Formation	2,200-2,500	670-760		
	Trw	Woodside Shale	~800	~245		
	Trd	Dinwoody Formation	~500	~150		UNCONFORMITY
PERM.	Pp Ppf	Franson Member of Park City Formation	240-300	75-90		Includes Rex Chert
	Pp Ppm	Meade Peak Member of Phosphoria Fm	170-300	50-90		
	Pp Ppg	Grandeur Member of Park City Formation	220-310	65-95		Wells Formation?
PENN.	IPw	Weber Sandstone	2,500-3,000	760-915		UNCONFORMITY
	IPm	Morgan Sandstone	0-1,000	0-305		Absent to north
	IPr	Round Valley Limestone	400	120		
MISS.	Mdo	Doughnut Formation	500	150		Monroe Canyon Limestone (Mmc) and Little Flat Formation (Mlf) in north
	Mh	Humbug Formation	700-900	215-275		
	Mde	Deseret Limestone	500+	150+		Delle Phosphatic Member
	Ml	Lodgepole Limestone	650-800	200-245		Fossiliferous
DEV.	Db	Bierdneau Sandstone	175-400	55-120		
	Dh	Hyrum Dolomite	200-725	60-220		
	Dwc	Water Canyon Formation	~330	~100		MAJOR UNCONFORMITY
CAMB.	Cn	Nounan Formation	~330	~100		
	Cm	Maxfield Limestone	600	180		
	Co	Ophir Formation	200-400	60-120		*Skolithus*
	Ct	Tintic Quartzite	800-1,500	245-460		CRAWFORD THRUST

Diagram is schematic--- no fixed thickness scale

Utah Geological Survey
a division of
Utah Department of Natural Resources
in cooperation with U.S. Geological Survey
STATEMAP Agreement Nos. HQ-96-AG1521
HQ-97-1797, and 98HQAG2067

Progress Report Geologic Map of the Ogden 30' x 60' Quadrangle, Utah and Wyoming - Year 3 of 3

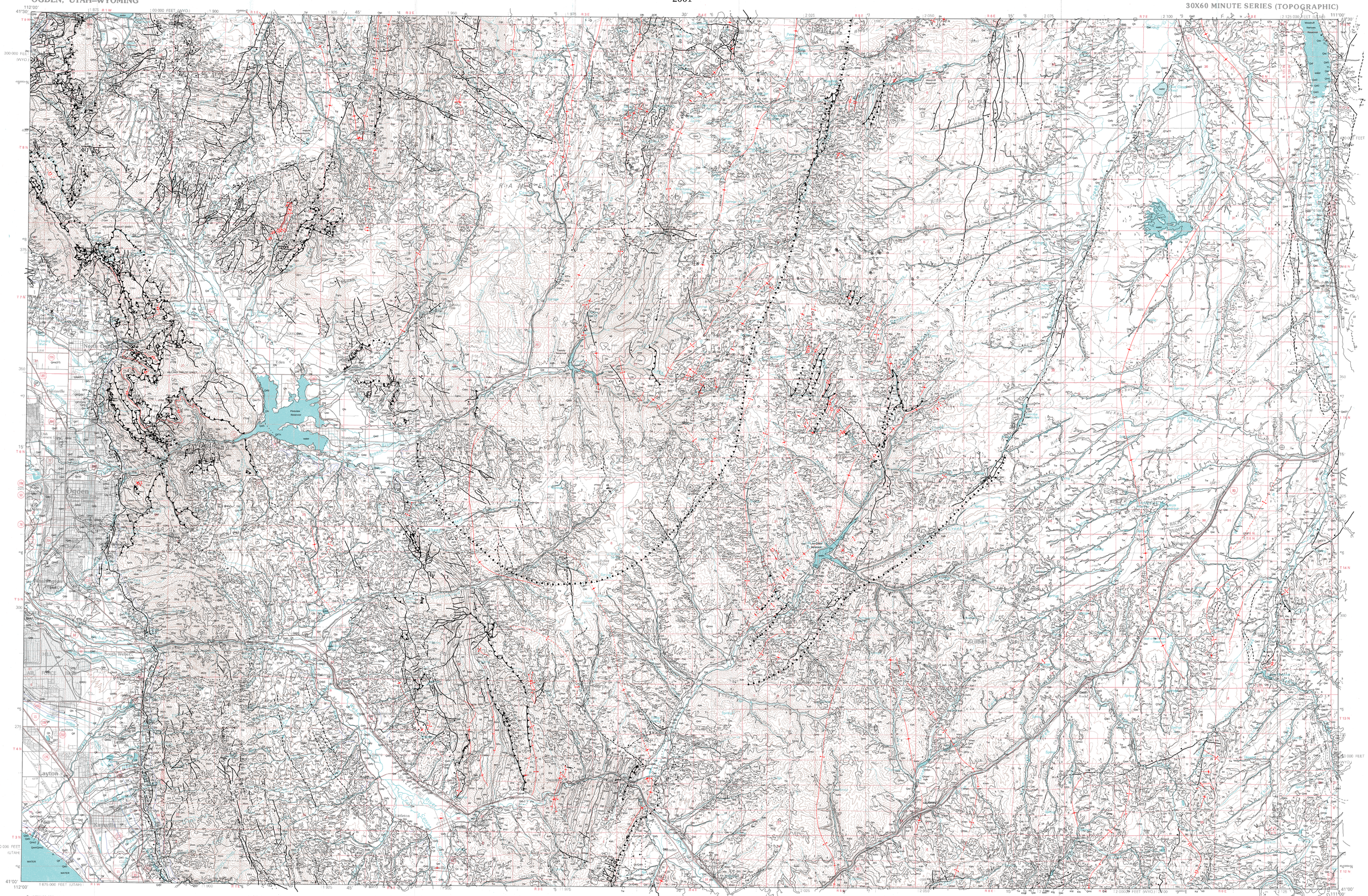
by
James C. Coogan and Jon K. King

2001

Open-File Report 380
Progress Report Geologic Map of the
Ogden 30' x 60' Quadrangle, Year 3 of 3

OGDEN, UTAH–WYOMING

30X60 MINUTE SERIES (TOPOGRAPHIC)



SCALE 1:100 000

1 CENTIMETER ON THE MAP REPRESENTS 1 KILOMETER ON THE GROUND

CONTOUR INTERVAL 50 METERS

KILOMETERS 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20

MILES 0 1 2 3 4 5 6 7 8 9 10 11 12 13

1000 0 5000 10 000 15 000 20 000 METERS

5000 0 10 000 20 000 30 000 40 000 50 000 60 000 70 000 FEET

OGDEN, UTAH–WYOMING
41111-A1-TM-100
1986

ArcMap plot at 1:100,000 scale of VRone data converted to .dxf file.
Base is a digital raster graph of U.S. Geological Survey Ogden 30' x 60' quadrangle topographic map.

This progress report makes the results of the third year of mapping on a three year project available to the public. This map consists of original mapping by Coogan and King with previous mapping compiled from many sources by King. Because the report is subject to review and may not conform to UGS policy and editorial standards, it may be premature for an individual or group to take action based on the contents. This material will not be reproduced when the final product has been released.


4E
5E
6E
7E
19
Woodruff Narrows Reservoir
Pineview Reservoir
WILLARD THRUST SHEET
Layton
WATER
WATER

CO for nes

Utah Geological Survey
a division of
Utah Department of Natural Resources

in cooperation with U.S. Geological Survey
STATEMAP Agreement No. 1434-HQ-96-AG-01521

OGDEN, UTAH–WYOMING

30X60 MINUTE SERIES (TOPOGRAPHIC)

OGDEN, UTAH–WYOMING
41111-A1-TM-100
1986

This progress report releases to the public the results of the first year of mapping on a three year project. This map consists of original mapping by Coogan combined with previous mapping compiled from many sources by King. Parts of the map are incomplete and other parts have not been reviewed. Inconsistencies, errors, and omissions have not been resolved. It may be premature for an individual or group to take action based on the contents.

The views and conclusions contained in this document are those of the authors and should not be interpreted as necessarily representing the official policies, either expressed or implied, of the U.S. Government.

Progress Report Geologic Map of the Ogden 30′x60′ Quadrangle, Utah and Wyoming -- Year 2 of 3.

By

James C. Coogan and Jon K. King