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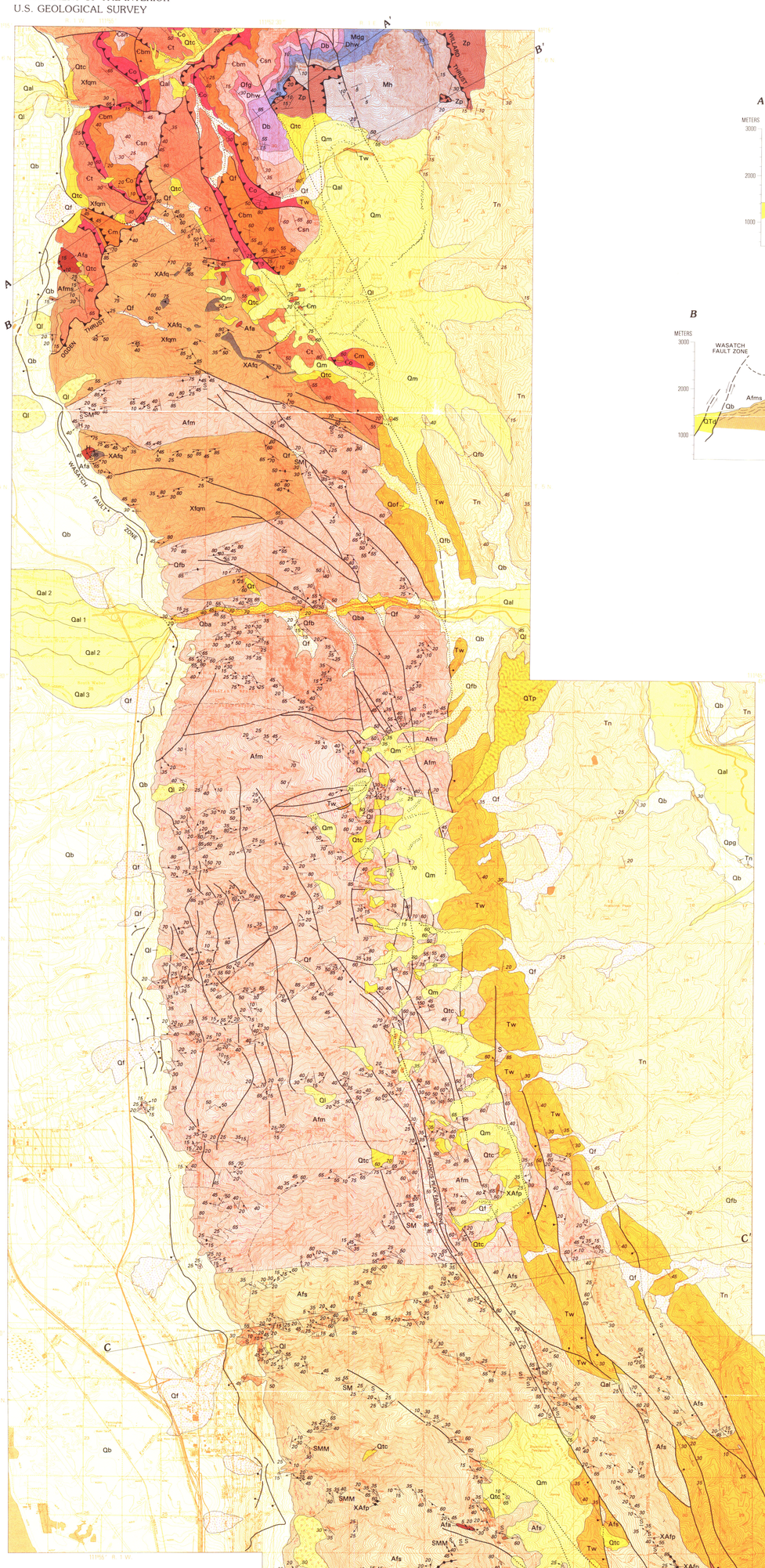
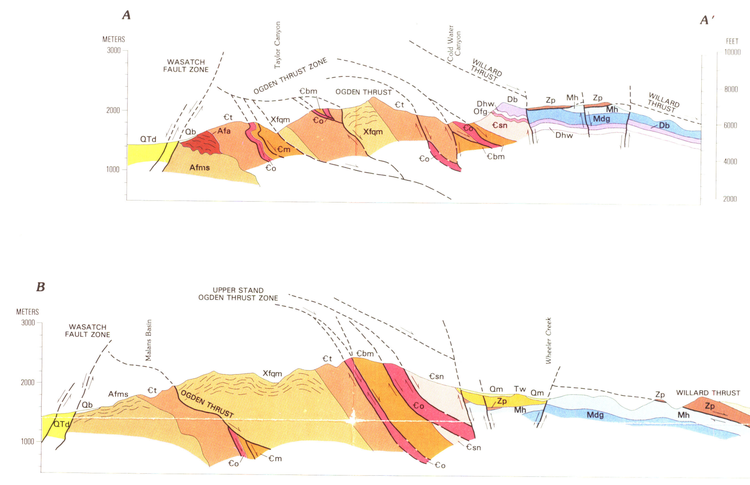
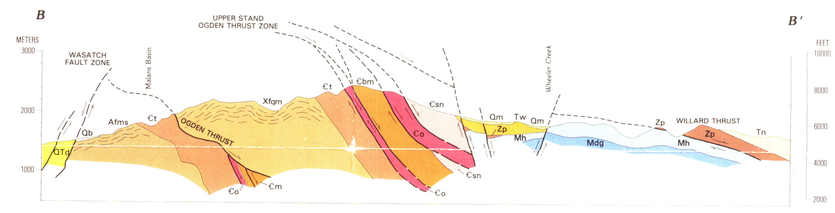
DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

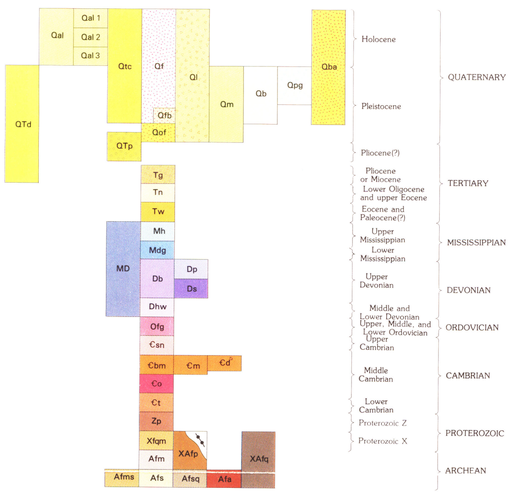
MISCELLANEOUS INVESTIGATIONS SERIES
MAP I-1447




## CORRELATION OF MAP UNITS




## DESCRIPTION OF MAP UNITS

**Qal** ALLUVIUM (HOLOCENE)—Gravel, sand, and silt. Includes terrace deposits $Qal_1$, $Qal_2$, and $Qal_3$ where the Weber River incised rocks of the Lake Bonneville Group

**Qtc** TALUS AND COLLUVIUM (HOLOCENE AND PLEISTOCENE)—Angular pebbles, cobbles, and boulders with or without a matrix of silt and sand

**Qf** DEBRIS FAN DEPOSITS (HOLOCENE AND PLEISTOCENE)—Boulder, cobble, and pebble gravel, sand, and silt. Many deposits along east side of range probably formed by outwash from glaciers in Pleistocene time

**Qfb** Fan deposits graded to high stand of Lake Bonneville

**Qof** OLD DEBRIS FAN DEPOSIT (PLEISTOCENE)—Boulder, cobble, and pebble gravel, sand, silt, and clay in highly dissected deposit on north side of lower Mill Creek

**Ql** LANDSLIDE DEPOSITS (HOLOCENE AND PLEISTOCENE)—Material ranging from boulders to silt in earthflows and debris slides

**Qba** ALLUVIUM, DEBRIS FAN DEPOSITS, AND LAKE BONNEVILLE GROUP (HOLOCENE AND PLEISTOCENE)—Mapped undivided in Weber Canyon

**Qm** TILL AND OUTWASH DEPOSITS (PLEISTOCENE)—Silt and sand containing many angular to rounded pebbles, cobbles, and boulders. Stippled pattern indicates prominent morainal ridges

**Qb** LAKE BONNEVILLE GROUP (PLEISTOCENE)—Gravel, sand, silt, clay, and marl deposited in Lake Bonneville. Coarse gravel concentrated at shoreline along west edge of Wasatch Mountains

**Qpg** Gravel—Gravel, sand, and silt forming terrace graded to Provo level of Lake Bonneville in Morgan Valley

**QTd** QUATERNARY AND TERTIARY DEPOSITS—Shown only in Salt Lake valley on cross sections

**QTp** PEDIMENT GRAVEL (PLEISTOCENE OR PLIOCENE?)—Boulder gravel capping surface south of Weber River east of Wasatch Mountains

**Tg** GRAVEL (PLIOCENE OR MIOCENE)—Angular pebbles, cobbles, and boulders, sand, and silt. Rocks derived from nearby parts of Wasatch Range. About 400 m exposed in southwest part of the mapped area

**Tn** NORWOOD TUFF (LOWER OLIGOCENE AND UPPER EOCENE)—White, light-gray, and pale-green tuff, altered tuff, tuffaceous sandstone and conglomerate, and gray to reddish-brown clay. Just east of area a stratigraphic horizon about two-thirds up in the section has a late Eocene fauna (Nelson, 1972) and a radiometric age of 37.5 m.y. (Evernden and others, 1964). About 1,300 m exposed

**Tw** WASATCH FORMATION (EOCENE AND PALEOCENE?)—Grayish-red to moderate-red sandstone, siltstone, conglomerate, and clay. Conglomerate contains boulders as much as 1 m in diameter mostly composed of Cambrian Tintic Quartzite and Precambrian quartzite. Gray conglomerate rich in limestone fragments, in upper Cataract Canyon west of Hardscrabble Creek. Closest age datum, which is 35 km east of map area, shows base of Wasatch is late Paleocene on basis of pollen analysis (D. J. Nichols). Thickness 400–1200 m; thickens to south

**Mh** HUMBUG FORMATION (UPPER MISSISSIPPIAN)—Dark- to light-gray, medium-bedded dolomite with beds of medium- to fine-grained, grayish-orange-weathering, light-gray sandstone and dolomitic sandstone. About 240 m exposed in northeast part of mapped area

**Mdg** DESERET AND GARDISON LIMESTONES, UNDIVIDED—Total thickness about 200 m

Deseret Limestone (Upper and Lower Mississippian)—Fine- to coarse-grained, dark- to light-gray dolomite and limestone with lenses of chert

Gardison Limestone (Lower Mississippian)—Upper part thick-bedded, medium-gray dolomite with lenses of chert. Lower part thin- to medium-bedded, light-bluish-gray-weathering, dark-gray to black fossiliferous limestone

**MD** MISSISSIPPIAN AND DEVONIAN ROCKS, UNDIVIDED—Shown only in cross section *E E'*

**Db** BEIRDNEAU SANDSTONE (UPPER DEVONIAN)—Medium-bedded to laminated, fine- to medium-grained, grayish-orange to brown-weathering sandstone, dolomitic sandstone, and dolomite. Mapped in northern part of area. About 75 m thick; tectonically thickened south of Sardine Canyon

**Dp** PINYON PEAK LIMESTONE (UPPER DEVONIAN)—Fine-grained, thin-bedded, yellowish- and pinkish-gray-weathering limestone, silty shale, and silty limestone. Mapped in southern part of area. About 105 m thick on Sessions Mountains; apparent thickness of 200 m on Hardscrabble Creek may be due to tectonic thickening

**Ds** STANSBURY FORMATION (UPPER DEVONIAN)—Thin-bedded, white to yellowish-gray sandstone with a few grayish-orange to moderate-red-weathering beds of silty sandstone; yellowish-gray-weathering siltstone and silty dolomite. At bottom, gray dolomite with interbeds of silty dolomite and sandstone. Mapped in southern part of area. About 105 m thick

**Dhw** HYRUM DOLOMITE AND WATER CANYON(?) FORMATION, UNDIVIDED

Hyrum Dolomite (Upper and Middle Devonian)—Thin- to thick bedded, fine- to medium-grained, dark- to light-gray weathering, dark-gray to black dolomite. Some beds of light-grayish-orange weathering silty dolomite and dolomitic siltstone in upper part. At base thinly laminated light-gray and dark-gray dolomite in 1–2 m beds may represent Lower Devonian Water Canyon Formation. About 60 m thick

**Ofg** FISH HAVEN DOLOMITE AND GARDEN CITY FORMATION, UNDIVIDED

Fish Haven Dolomite (Upper Ordovician)—Medium- to thick-bedded, fine- to medium-grained, medium- to pale-gray dolomite. About 50 m thick

Garden City Formation (Middle and Lower Ordovician)—Thin- to medium-bedded, grayish-orange-weathering, medium- to pale-gray and very pale orange dolomite, commonly with sandy streaks and lenses. Interbedded thinly laminated, medium- to yellowish-gray, grayish-orange weathering siltstone. About 100 m thick

**Csn** ST. CHARLES FORMATION AND NOUNAN DOLOMITE, UNDIVIDED

St. Charles Formation (Upper Cambrian)—Thin- to thick-bedded, fine- to medium-grained, white to light-gray dolomite. About 200 m thick. Worm Creek Quartzite Member, at base—Thin-bedded, fine- to medium-grained, medium-gray sandy dolomite with shale partings. About 2 m thick

Nounan Dolomite (Upper and Middle Cambrian)—Thin- to thick-bedded, fine-grained, light- to medium-gray dolomite. About 100 m thick

**Cbm** CALLS FORT SHALE MEMBER OF THE BLOOMINGTON FORMATION AND MAXFIELD LIMESTONE, UNDIVIDED (MIDDLE CAMBRIAN)

Calls Fort Shale Member of the Bloomington Formation—Olive-green to light-brown shale and light- to dark-bluish-gray limestone with intercalated pale-yellowish-orange to dark-yellowish-orange silty limestone; intraformational conglomerate common. About 50 m thick

Maxfield Limestone—Total thickness about 240 m in south part of area; 350 m in north. Subject to much tectonic thickening and thinning

Upper part—Thin-bedded, fine-grained, medium- to dark-gray dolomite with intercalated light-gray silty limestone

Middle part—Olive-green micaceous shale and medium- to dark-gray limestone

Lower part—Light-gray-weathering, dark-blue-gray limestone and dolomite with light-grayish-orange silty limestone intercalated in lenses and thin beds

**Ꞓm** MAXFIELD LIMESTONE (MIDDLE CAMBRIAN)

**Ꞓd** DOLOMITE (MIDDLE CAMBRIAN)—Thick- to thin-bedded, light- to dark-gray dolomite. Mapped east of Hardscrabble Creek. Probably is the upper part of the Maxfield Limestone. About 100 m exposed

**Ꞓo** OPHIR FORMATION (MIDDLE CAMBRIAN)—Approximate stratigraphic thickness 150–200 m; much tectonic thinning and thickening

Upper part—Thin-bedded, light-blue-gray limestone, shaly limestone, and light-greenish- to olive-gray shale

Middle part—Fine-grained, medium-blue-gray-weathering limestone with lenses of light-grayish-brown-weathering silty limestone

Lower part—Light-brown to olive-green micaceous shale and phyllite

**Ꞓt** TINTIC QUARTZITE (MIDDLE AND LOWER CAMBRIAN)—Thin- to thick-bedded, medium- to coarse-grained, very pale orange to grayish-orange-weathering, white quartzite. Abundant cross bedding. Lenses and beds of quartz pebble conglomerate in lower part, especially at base. About 450 m thick in the north part of the mapped area, and about 600 m thick in the south part

**Zp** FORMATION OF PERRY CANYON (PROTEROZOIC Z)—Pale-grayish-orange-weathering micaceous meta-arkose and quartzite and greenish-gray phyllite near Willard thrust. Graywacke and micaceous siltstone elsewhere (Sorensen and Crittenden, 1979). About 150 m exposed in mapped area

FARMINGTON CANYON COMPLEX (PROTEROZOIC X AND ARCHEAN)

Isotopic studies (Hedge and others, 1983) indicate that the protoliths (sandstone, shale, basalt, and, perhaps, silicic igneous rock) for these metamorphic rocks are 2,600–3,000 m.y. old. They probably underwent a major metamorphism 2,600 m.y. ago. Rb-Sr and U-Pb data show that the quartz monzonite gneiss is 1,790 m.y. old and was derived by melting of upper crustal material. The emplacement of the quartz monzonite gneiss was followed by an amphibolite facies metamorphism

**Xfqm** Quartz monzonite gneiss (Proterozoic X)—White to light-gray, pinkish-gray to yellowish-gray-weathering, fine- to medium-grained biotite-hornblende quartz monzonite gneiss containing some lenses of greenish-black amphibolite. Contains sparse to abundant white to pinkish-gray pegmatite veinlets and stringers 1–10 cm thick with sharp to indistinct borders. Lenses and pods of amphibolite generally are 0.5 to a few meters thick and a few to tens of meters long

**XAfp** Pegmatite (Proterozoic X and Archean)—White, very light gray to very pale orange plagioclase-quartz-microcline and quartz-microline pegmatite locally containing muscovite or biotite books to several cm in diameter. Only a few of the largest bodies mapped

**XAfq** Quartzite (Proterozoic X and Archean)—Light-greenish-gray to light-gray, grayish-red and dark-gray quartzite, hematite quartzite, sericite quartzite, and chlorite–epidote-sericite quartzite. Occurs as inclusions or altered, silicified zones in quartz monzonite gneiss

**Afm** Migmatite (Archean)—Interlayered and intergradational white to light-gray biotite-hornblende quartz monzonite gneiss, gray biotite-garnet-feldspar-quartz schist and gneiss, white garnet-quartz feldspar gneiss, greenish-black amphibolite, medium-gray garnet-biotite schist and sillimanite-garnet-biotite schist. Lenses and layers of white to pinkish-gray pegmatite 1–10 cm thick, some with indistinct and some with sharp borders, abundant and commonly discordant, larger, more sharply bounded, pegmatites 1–10 m thick. Contacts with **Xfqm** and **Afs** gradational

**Afms** Mica schist (Archean)—Medium-gray muscovite-biotite-plagioclase-quartz schist with micas as much as 5 mm in diameter. Contains some amphibolite. Mapped in lower Waterfall Canyon and Strongs Canyon in north west part of area

**Afs** Schist and gneiss (Archean)—Light- to medium-gray biotite-feldspar-quartz gneiss, garnet-biotite-feldspar-quartz gneiss, sillimanite-biotite schist, sillimanite-garnet-biotite schist and gneiss, hornblende-biotite schist, and less abundant layers of white, coarse-grained quartzite. Lenses and layers of amphibolite. Pegmatite dikes and sills; some with indistinct and others with sharp borders; pegmatites with sharp contacts cut those with indistinct contacts and tend to be discordant. Sharply bounded discordant pegmatites more abundant in this unit than in **Afm** to north and are generally 10–30 m long, but a few are as much as several hundred meters long

**Afsq** Schist, gneiss, and quartzite (Archean)—Light- to medium-gray biotite-feldspar-quartz schist, sillimanite-biotite schist, sillimanite-garnet-biotite schist and gneiss, and layers of coarse grained quartzite as much as 10 m thick. Quartzite dominates much of the unit and is white to pale yellowish green, and has a grain size of 4–5 mm; contains some light-green muscovite and has a few heavy mineral partings. Amphibolite in lenses and layers. Contact with **Afs** gradational

**Afa** Amphibolite (Archean)—Greenish-black generally nonlayered hornblende-plagioclase amphibolite; only a few of the largest bodies mapped. Occurs as lenses 0.5 m to 10 m thick throughout Farmington Canyon Complex. Some rocks contain monoclinic pyroxene, especially in northern part of area, and some contain quartz. Some rocks have aggregates of plagioclase suggesting relict porphyritic textures. A few bodies in the quartz monzonite gneiss are metagabbro and may have intruded before or during the Proterozoic metamorphism

CONTACT—Long-dashed where gradational

FAULT—Dotted where concealed. Bar and ball on downthrown side

THRUST FAULT—Dotted where concealed. Teeth on upper plate

STRIKE AND DIP OF BEDS
- Inclined
- Vertical
- Overturned

STRIKE AND DIP OF FOLIATION
- Inclined
- Vertical

STRIKE AND DIP OF FOLIATION AND COMPOSITIONAL LAYERING
- Inclined
- Vertical

STRIKE AND DIP OF CATACLASTIC FOLIATION AND FOLIATION IN RETROGRESSIVELY METAMORPHOSED ROCK
- Inclined
- Vertical

BEARING AND PLUNGE OF MINERAL LINEATION—May be combined with foliation symbols
- Inclined
- Horizontal

OCCURRENCE OF METAMORPHIC INDEX MINERALS AND MINERAL ASSEMBLAGES—Fragmentary evidence indicates lowest grade in southern part of area
- S — Megascopically determined sillimanite
- S — Microscopically determined sillimanite
- SMU — Sillimanite and muscovite
- SM — Sillimanite and microcline
- SMM — Sillimanite, microcline, and muscovite
- H — Relict hypersthene

AREA OF SHEARED AND RETROGRESSIVELY METAMORPHOSED ROCK—Much of the rock is sheared to phyllonite, mylonitic gneiss, mylonite, and silicified blastomylonite and is retrogressively metamorphosed. Chlorite, epidote, and albite are characteristic new minerals. Boundaries of areas of sheared rock are indistinct and indicated by short-dashed lines; small areas and thin elongate zones of sheared and retrogressively metamorphosed rocks occur outside mapped areas; some lenses of rock inside these areas have escaped shearing and retrogressive metamorphism

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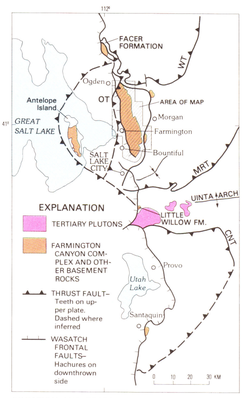
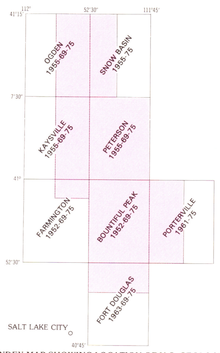
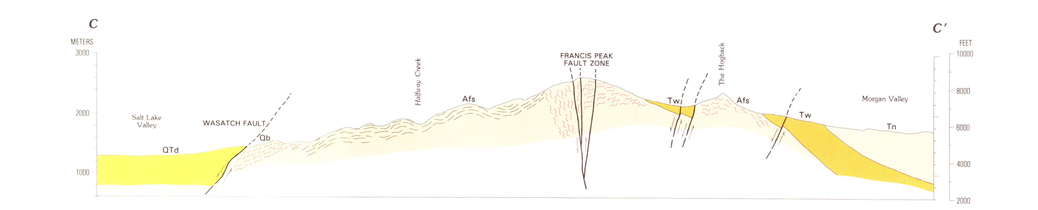


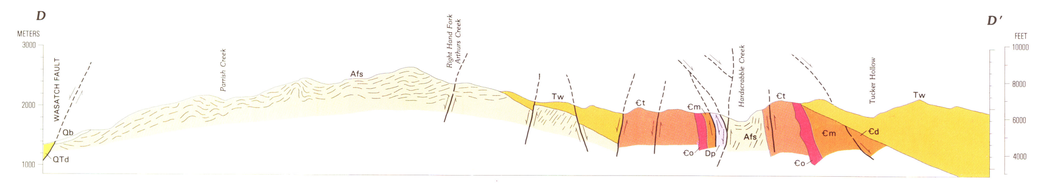

LOCATION AND TECTONIC SETTING OF AREAS OF PRECAMBRIAN CRYSTALLINE ROCK IN NORTH CENTRAL UTAH. Modified from Stokes (1962) and Crittenden (1972, 1974). OT, Ogden Thrust; WT, Willard Thrust; MRT, Mt. Raymond Thrust; CNT, Charleston-Nebo Thrust. Major inferred faults not named.

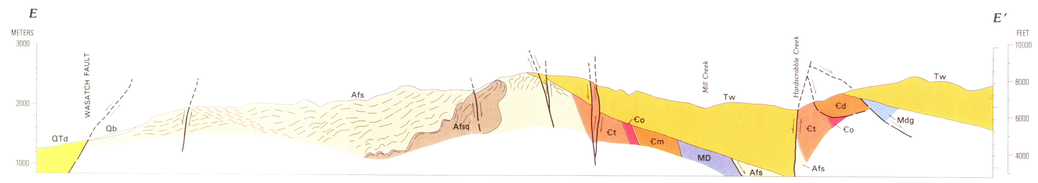



INDEX MAP SHOWING LOCATION OF U.S. GEOLOGICAL SURVEY 1:24,000 QUADRANGLES USED FOR BASE MAP

Geology mapped, 1977–78, assisted by Peter R. Moon, 1977. Geology in part of the Ogden River Canyon from Sorensen and Crittenden (1979); position of Holocene faults along the Wasatch mountain front from Cluff and others, (1970); surficial geology in Salt Lake Valley modified from Miller (1980); some contacts north of lower Mill Creek from Van Horn (1975); some in lower Taylor Canyon from Bruhn and Beck (1980).




SCALE 1:50 000

CONTOUR INTERVAL 20 AND 40 FEET
WITH SUPPLEMENTARY CONTOURS AT 5 AND 10 FOOT INTERVALS
NATIONAL GEODETIC VERTICAL DATUM OF 1929

# RECONNAISSANCE GEOLOGIC MAP OF THE PRECAMBRIAN FARMINGTON CANYON COMPLEX AND SURROUNDING ROCKS IN THE WASATCH MOUNTAINS BETWEEN OGDEN AND BOUNTIFUL, UTAH

By
Bruce Bryant