UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

PRELIMINARY GEOLOGIC MAP AND CROSS SECTIONS OF THE TETONS QUADRANGLE AND ADJACENT PART OF THE OBSERVATION KNOLL QUADRANGLE, BEAVER AND IRON COUNTIES, UTAH

by

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DESCRIPTION OF MAP UNITS

Qac ALLUVIUM AND COLLUVIUM (Quaternary)--Unconsolidated poorly sorted stream, fan, slope-wash, and talus deposits. The unit includes detritus of the unit Tbrt as talus aprons around The Tetons and as a mantle on a pediment between The Tetons and Jockey Road. Total thickness probably does not exceed 40 m

FORMATION OF BLAWN WASH (Miocene)

Tbrt Rhyolite of The Tetons--Light-gray, pink, lavender, or brown porphyritic rhyolite flows, domes, and intrusions; contains only a few small (≤1 mm) phenocrysts of smoky quartz, sanidine, and plagioclase in a microcrystalline matrix. Some units are locally spherulitic and lithophysal, containing topaz and rare fluorite in vugs. Hypothetical intrusive body in southwestern part of map area may be of rhyolitic composition but it is nowhere exposed; in cross sections B-B', C-C', and D-D' it is shown to be a bysmalith. According to Lindsey and Osmonson (1978), sanidine from the intrusive rhyolite plug in the W1/2 sec. 31, T. 15 W., R. 29 S. has a K-Ar age of 20 m.y.

Tbrb Intrusion breccia--Irregular masses of altered and unaltered angular breccia within the intrusive plug near the Staats mine, and similar to it in composition. It may represent an early breccia filling of a volcanic conduit

Tbrp Rhyolite of Pink Knolls--Flows, intrusive plugs, and dikes of gray to brown strongly porphyritic rhyolite; locally vitrophyric. Phenocrysts of quartz, sanidine, plagioclase, and lesser biotite comprise as much as one-third of the rock. Sanidine and quartz phenocrysts range from small crystals to prominent phenocrysts as much as 3 cm and 1 cm long, respectively, even in individual outcrops

Tbt Tuff member--A sequence of light-colored generally loosely consolidated vitric-lithic ash-flow and minor air-fall tuffs with intervening beds of stratified water-laid tuffs, volcanic sandstones, and conglomerates. The topaz rhyolite at The Tetons is underlain by a strongly welded ash-flow tuff with lenses of black or brown glass derived from collapsed pumice fragments. Most of the tuffaceous beds in the unit contain less than 10 percent phenocrysts of quartz, plagioclase, sanidine, and biotite, and have abundant pumice lapilli. Fragments of the Lund Tuff Member of the Needles Range Formation as much as 25 cm across are typically present, and are especially common in the epiclastic beds. Scattered fragments of Lund commonly are the only indication of the Tbt unit beneath poorly exposed slopes. The unit appears to be composed of locally derived material, in part representing the precusory explosive facies of younger rhyolite flows and intrusions. Possibly as much as 300 m of this unit is exposed in Blawn Wash

Tbm — Mafic flow member--Gray lava flows containing phenocrysts of augite and labradorite; unit commonly weathers brown with red liesegang bands; zeolite amygdules are locally abundant. In this and adjacent quadrangles the unit ranges from 55 to 60 weight percent SiO_2 and 2.4 to 4.0 percent K_2O. Thickness 200 m

Tbtg — Garnet-bearing tuff member--Identical to the unit Tbt except for the presence of rare dark-red euhedral garnet phenocrysts 1 to 2 mm in diameter. Some of the areas of altered rock designated as unit Tbt on the map may be of this unit. Thickness 210 m in Blawn Wash

Tcb — BAUERS TUFF MEMBER OF THE CONDOR CANYON FORMATION (Miocene)--Strongly welded vitric ash-flow tuff with about 15 percent phenocrysts of plagioclase, sanidine, and biotite in a pale-gray to pink or lavender matrix. Thickness about 10 m. Fleck and others (1975) report an age of 22 m.y.

Ta — ANDESITE (Oligocene)--Gray andesite with small pyroxene phenocrysts, weathers to brown chips. Thickness 300 m

Ti — ISOM FORMATION (Oligocene)--Densely welded vuggy ash-flow tuff with intensely compressed and locally stretched lenticles of light-colored pumice in a purple to red-brown lithoidal matrix. Commonly weathers to a grus. Phenocrysts of plagioclase, minor pyroxene, and Fe-Ti oxides comprise less than 10 percent of rock. Thickness may be as great as 20 m, but it is difficult to ascertain because of possible secondary flowage and internal contortion of foliation after emplacement. Age is 25 m.y. according to Fleck and others (1975)

Tqc — VEINS OF QUARTZ AND CALCITE (Oligocene)--Tabular steeply dipping lenses of quartz, calcite, and possibly dolomite 1 to 10 m wide. Precise age is unknown but the youngest rock unit cut by the veins is the Wah Wah Springs Tuff Member of the Needles Range Formation

NEEDLES RANGE FORMATION (Oligocene)--Crystal-rich gray, red-brown, or purple-brown ash-flow tuff sheets including the Wallaces Peak Tuff, Lund Tuff, Wah Wah Springs Tuff, and Cottonwood Wash Tuff members. All members contain 40 to 50 percent phenocrysts of plagioclase (generally about 25 percent), biotite, hornblende, and quartz. Age is 29 m.y. according to Fleck and others (1975)

Tnwp — Wallaces Peak Tuff Member--Gray moderately welded tuff with conspicuous white pumice lapilli. Blocky plagioclase phenocrysts as much as 6 mm across and euhedral biotite and hornblende phenocrysts are prominent but small quartz phenocrysts are inconspicuous. Only exposed in Blawn Wash where it is 30 to 60 m thick

Tnl — Lund Tuff Member--Strongly welded tuff commonly identified by flattened white pumice lapilli; contains plagioclase, biotite, fairly abundant quartz, and minor hornblende phenocrysts. An apparently unfaulted section between Blawn Wash and Jockey Road is 250 m thick; near The Tetons it also is about 250 m thick, whereas near the south edge of the quadrangle apparently unfaulted sections are at least twice as thick

Tnw — Wah Wah Springs Tuff Member--Strongly welded tuff with prominent hornblende phenocrysts but less than 1 to 2 percent of small quartz phenocrysts. Flattened pumice lapilli locally are conspicuous. East of The Tetons the unit is at least 120 m thick

Tnc — Cottonwood Wash Tuff Member--Strongly welded tuff with prominent euhedral biotite phenocrysts up to 8 mm in diameter and several percent quartz phenocrysts as much as 4 mm; hornblende phenocrysts are inconspicuous in hand sample. Generally less than 20 m thick

Te — ESCALANTE DESERT FORMATION (Oligocene)--A sequence of crystal-poor lithic rhyolitic to quartz-latitic ash-flow tuffs, andesitic and rhyolitic lava flows, and volcanic sandstone described by Grant (1978) and Campbell (1978). "The type section for the formation is the northeast flank of hill 6535 (Lund Quadrangle), sec. 6, T. 32 S., R. 14 W. It includes all lithologies from the first ash-flow above the volcanic conglomerate to the base of the Wah Wah Springs Tuff Member of the Needles Range Formation" (Grant, 1978, p. 27). The name is taken from the large flat desert valley that extends into the southeast half of the Lund Quadrangle at the southern end of the Wah Wah Mountains

Teb — Beers Spring Member--Greenish-brown well-sorted volcanic sandstone. Exposed thickness ranges from a meter or so to as much as 400 m south of Jockey Road where a local lense of pyroxene- and plagioclase-bearing phyric andesite and a firmly welded ash-flow tuff resembling unit Tel are included

Tefu — Upper quartz latite flow member--Lavender-gray generally delicately flow layered flow rocks that weather into hackly plates and grus; contains less than 20 percent phenocrysts of plagioclase and biotite; SiO_2 about 67 weight percent and K_2O 4 to 5 weight percent. About 100 m thick

Tel — Lamerdorf Tuff Member--Lavender to brown firmly welded quartz-latitic ash-flow tuff with about 10 percent chalky plagioclase and lesser biotite phenocrysts; dark-colored lithic fragments and intensely flattened pumice lapilli are conspicuous. Between Blawn Mountain and The Seeps the unit includes small amounts of the units Teb and Tefu. Thickness 50 to 100 m

Tefl — Lower quartz latite flow member--Similar to the unit Tefu except that plagioclase phenocrysts are larger, less abundant, and the rock breaks down into smooth chips and slabs. Thickness 60 to 150 m

Tea — Andesite member--Characterized by phenocrysts of green pyroxene and plagioclase in a black aphanitic to glassy matrix; weathers into brown blocks. Thickness 0 to 300 m

Tem — Tuff of Marsden Spring--Pale greenish-gray to white tuff locally bedded; contains only scattered phenocrysts of quartz and feldspar; fragments of pink to purple quartzite are conspicuous. Thickness 0 to 150 m

Tv — VOLCANIC ROCKS, UNDIVIDED (Miocene and Oligocene)--Rock masses whose stratigraphic identity is uncertain because of intense alteration

LOWER PLATE OF BLUE MOUNTAIN THRUST

Jn — NAVAJO SANDSTONE (Jurassic)--Tan, yellowish-gray, or white medium- to fine-grained aolian cross-bedded sandstone. Sand grains are frosted throughout formation. About 650 m thick. Underlies Blue Mountain thrust fault throughout Wah Wah Mountains

Trc — CHINLE FORMATION (Triassic)--Assumed to underlie the Navajo Sandstone in the lower plate of the Blue Mountain thrust. Typically this formation in nearby areas consists of an upper member of red, lavender, and green sandstone, siltstone, and shale, commonly containing nodules of limestone, and the basal Shinarump Member, about 10 m or less in thickness, a yellow-brown or red matrix conglomerate characterized by pebbles of limestone, chert, and fossil wood. Near the concealed intrusion believed to occur in the southwestern part of the map area the shale and siltstone beds may be altered to dark-brown hornfels as they are in the adjacent Blue Mountain quadrangle (Weaver, 1980, p. 121). In this report the Chinle Formation is shown only in cross sections. Total thickness about 100 m

Trm — MOENKOPI FORMATION (Triassic)--Assumed to underlie Chinle Formation and Navajo Sandstone. Predominantly brown to red shale, siltstone, and sandstone with two or more horizons containing beds of light-gray limestone. Near the concealed bysmalithic intrusion the argillaceous beds may be converted to dark-brown to brownish-black hornfels as they are in the Blue Mountain quadrangle (Weaver, op. cit., p. 121). Shown only in cross sections. Thickness unknown but probably about 700 m.

UPPER PLATE OF BLUE MOUNTIAN THRUST

LIMESTONE OF ROSE SPRING CANYON (Mississippian)--A moderately thick sequence of somewhat heterogeneous strata that is similar in many respects to the Upper Mississippian Battleship Wash Formation of the Bird Spring Group of Langenheim and Langenheim (1965) exposed in the Arrow Canyon Range of southeastern Nevada. In Wah Wah Mountains the limestone of Rose Spring Canyon is readily divisible into two members:

Mrsu Upper member--Interbedded blue-gray medium-bedded cherty fossiliferous limestone, and buff to greenish-brown medium-grained sandstone, with some minor beds of fine-grained argillaceous dolomite. Commonly contains large and small masses of gray hydrothermal jasperoid. Top is concealed, but total thickness is estimated to be about 300 m

Mrsl Lower member--Mostly buff to reddish-tan medium-bedded medium- to fine-grained sandstone and some similar colored siltstone, with a conspicuous zone of gray thin- to medium-bedded sparsely cherty argillaceous dolomite in the middle. Possibly correlative with Scotty Wash Quartzite of southeastern Nevada (Westgate and Knopf, 1932). Base is cut out by a fault in Wah Wah Mountains; total thickness is estimated to be about 225 m

Mmc MONTE CRISTO LIMESTONE (Mississippian)--Medium- to bluish-gray medium- to thick-bedded medium- to fine-grained fossiliferous limestone. The lower one-third of the Monte Cristo is somewhat thinner bedded than the middle and upper part of the formation, and locally contains small to moderate quantities of dispersed sand and silt. The upper two-thirds is free of sand and silt and is characterized by moderate to abundant nodules, stringers, and lenses of dark-brown to black chert. Like the Monte Cristo Limestone in its type area in the Spring Mountains of southeastern Nevada (Hewett, 1931, p. 18-21), the Monte Cristo of the southern Wah Wah Mountains is believed to be of Lower and Middle Mississippian age. Top of Monte Cristo Limestone is faulted out in The Tetons quadrangle, but the complete formation is estimated to be about 200 m thick

Dcp CRYSTAL PASS LIMESTONE MEMBER OF SULTAN LIMESTONE (Devonian)--Medium- to dark-bluish-gray medium- to thin-bedded locally sand-streaked somewhat silty limestone or dark-gray medium- to coarse-grained hydrothermal dolomite, containing lenses and beds of medium-grained brown-weathering quartzite or sandstone that are a few centimeters to 2 m thick. Some of the limestone beds contain moderately well preserved brachiopods including Paurorhychia endlichi, Cyrtospirifer sp., amd other Upper Devonian forms. Thickness of Crystal Pass Limestone in The Tetons area averages about 100 m

Dcf COVE FORT QUARTZITE OF CROSBY (1959) (Devonian)--Irregular lenses of white, buff, and dark-brown medium- to coarse-grained porous quartzite overlying the extensive unconformity at the top of the Simonson Dolomite. Locally contains thin layers of blue-gray fine-grained argillaceous limestone or dolomite. Thickness ranges from a few centimeters to about 30 m

Dsi LOWER PART OF SIMONSON DOLOMITE (Devonian)--Medium- to dark-brownish-gray medium- to thick-bedded medium- to coarse-grained dolomite locally containing a few beds of light gray dolomite. Fossils are sparse but many so called "spaghetti beds" contain masses of Amphipora. Regional studies indicate that the upper part of the Simonson Dolomite, and the Guilmette Formation that overlies it elsewhere, were removed by erosion prior to the deposition of the overlying Cove Fort Quartzite of Crosby (1959) or the Crystal Pass Limestone Member of the Sultan Limestone. The thickness of the remaining part of the Simonson is about 150 m

Dse SEVY DOLOMITE (DEVONIAN)--Medium- to light-gray medium-bedded to massive faintly laminated dense dolomite. Commonly weathers chalk white, but on fresh fractures is light olive to pinkish gray. In some areas the upper one-third of the Sevy is medium to coarse grained and has a sandy texture. Fossils are rare to absent throughout the formation. Thickness is 100 to 250 m

Sl LAKETOWN DOLOMITE (Silurian)--Medium- to light-gray medium- to thick-bedded medium- to coarse-grained dolomite. Fossils are rare, but large radial colonies of Favosites and sparse gastropods help identify the formation in some areas. Locally near the Staats pluton areas of bleached and weakly contact-metasomatized Laketown Dolomite superficially resemble the Sevy and Simonson Dolomites. Thickness ranges from 350 to 400 m

Ofh FISH HAVEN DOLOMITE (Ordovician)--Medium- and dark-gray to black medium-bedded medium- to coarse-grained dolomite. In some areas the middle one-third of the formation is predominantly composed of medium- to light-gray dolomite, but these zones may be the result of hydrothermal alteration that has bleached and modified large parts of the formation near plutons and faults. Some of these bleached areas superficially resemble the Sevy and Simonson Dolomites. In comparison to the Laketown Dolomite, which it generally resembles, the unaltered Fish Haven is somewhat darker toned and contains many more fossils. In the upper plate of the Tetons thrust the Fish Haven is about 250 m thick and is uncommonly fossiliferous, containing large specimens of Catenipora sp., Favosites sp., Deiracorallium sp., and Grewingkia sp. all identified by W. A. Oliver, Jr. (written commun., August 8, 1981), as well as large, high-spired gastropods. In the lower and upper plates of the underlying Dry Canyon thrust the Fish Haven is only about 110 m thick, or less, and is only sparsely fossiliferous, except for some beds that contain the small horn coral Bighornia and the halysitid coral Catenularia, which are particularly abundant in the upper one-third of the formation. Generally the upper contact of the Fish Haven is placed at the uppermost dusky-gray to black dolomite bed containing Bighornia (Miller, 1959, p. 40)

Oe EUREKA QUARTZITE (Ordovician)--White, buff, or pinkish-gray, medium-bedded fine- to very-fine-grained orthoquartzite. Locally it weathers yellow, tan, or reddish brown. In the upper plate of the Tetons thrust, only incomplete sections of the Eureka are exposed, but in the adjacent part of the Lamerdorf Peak quadrangle (Abbott and others, 1981) it overlies the Kanosh Shale and is about 50 to 70 m thick. In the upper and lower plates of the Dry Canyon thrust where it may have been affected by attenuation faulting, the Eureka rests directly on the Juab Limestone and is only about 7 to 10 m thick

POGONIP GROUP (Ordovician)--In nearby parts of western Utah (Hintze, 1973), the Pogonip Group consists, in ascending order, of the House Limestone, Fillmore Formation, Wah Wah Limestone, Juab Limestone, Kanosh Shale and, locally, the Lehman Formation. In the upper plate of the Tetons thrust in the adjacent Lamerdorf Peak quadrangle, the exposed part of the Pogonip Group consists of at least parts of the Juab Limestone, the Kanosh Shale, and possibly the Lehman Formation. In the lower plate of the Dry Canyon thrust no Kanosh Shale or Lehman Formation are present, and the Eureka Quartzite rests directly on the Juab Limestone

Ok KANOSH SHALE--Medium- to dark-brownish-green or olive green fissile shale containing lenses of gray or brown medium-grained sandstone and brown, buff, and light-bluish-gray, silty limestone. Graptolites are common in some of the shale beds, and orthid brachiopods are fairly abundant in some thin interbedded calcarenite coquinas. The Kanosh Shale occurs only in the plate of the Tetons thrust, where it is much sheared by bedding plane thrust faults; it ranges in thickness from 8 to 35 m. Shown only in cross-sections

Oj JUAB LIMESTONE--Medium-blue-gray thin-to medium-bedded medium-grained silty limestone with scattered lenses of brownish-green shale and limestone flat-pebble conglomerate. Base is concealed but is probably underlain, in decending order by the Wah Wah Limestone, Fillmore Formation, House Limestone, all of Ordovician age, and the Notch Peak Formation of Ordovician and Cambrian age.

COVERED AREA

Cob BIG HORSE LIMESTONE MEMBER OF ORR FORMATION (Cambrian)--Medium-gray to brownish-gray mottled and striped dolomitized limestone containing a zone of fossiliferous oolite about 15 m thick at base. According to L. F. Hintze (written commun., Sept. 10, 1980) this oolite contains Meteoraspis and other representatives of the Crepicephalus trilobite zone, diagnostic of early Late Cambrian time. Only about 75 m of the Big Horse Limestone Member are exposed but it is probably overlain, in turn, by the upper part of the Big Horse Limestone Member, which has a total thickness of about 600 m, the Steamboat Pass Shale Member, the Notch Peak Formation, and the succeeding formational units of the Ordovician Pogonip Group

Cws WAH WAH SUMMIT FORMATION (Cambrian)--Mostly medium- to brownish-gray medium-bedded somewhat granular dolomitic limestone containing some relatively thin beds and zones of dusky-gray dolomite and medium- to light-gray dolomite. Top of formation is faulted out but remaining part of section is about 325 m thick

Ctr TRIPPE LIMESTONE (CAMBRIAN)--Alternating light-gray to creamy-white laminated dolomite, commonly termed boundstone, and dark-gray mottled dolomite in bands 1 to 10 m thick. A boundstone zone about 20 m thick marks the base of the formation, and other highly conspicuous zones of boundstone make up about 30 to 40 percent of the overlying beds. The upper part of the Trippe is moderately thin bedded, but the Fish Springs Member, described by Hintze (1974) in the northern part of the Wah Wah Mountains, is not recognized in The Tetons quadrangle. Thickness about 200 m

ϵpc PIERSON COVE FORMATION (Cambrian)--A thick sequence of dark gray thick-bedded clayey and silty limestone and dolomite with minor shale lenses. Most of the formation consists of dull somber limy mudstone mottled with light-olive to brownish-gray dolomitic mudstone. Next in abundance is massive finely crystalline medium-gray limestone or dolomite commonly studded with small, white dolomite rods, filled tubes, or blebs. Least in abundance but highly conspicuous is faintly yellowish-gray laminated dolomite boundstone that forms light-colored zones at the base, near the middle, and at the top of the formation. About 500 m thick

ϵen EYE OF NEEDLE LIMESTONE (Cambrian)--This formation is near the southern limit of its area of occurrence and is only doubtfully recognized in The Tetons quadrangle. The name is here applied to a zone of mostly light-gray thick-bedded to massive medium- to fine-grained micritic limestone. Locally includes some dark limestone beds containing short white dolomite rods or filled tubes. Contact with underlying Swasey Limestone arbitrarily selected. Thickness about 120 to 170 m

ϵs SWASEY LIMESTONE (Cambrian)--Medium- to light-gray thick-bedded to massive limestone or dolomite. Some beds in lower part are oolitic or pisolitic, and rod-shaped dolomite blebs are common throughout. Formation possibly should be extended upward to include beds here mapped as Eye of Needle Limestone. Thickness about 165 to 200 m

ϵw WHIRLWIND FORMATION (Cambrian)--Brown-weathering olive-green fissile shale containing sparse thin lenses of sandy or silty limestone and limestone flat-pebble conglomerate. Some thin beds in the upper part of the formation are almost completely composed of the fossilized fragments of disarticulated trilobites of the genus Ehmaniella. About 40 m thick

ϵdp DOME LIMESTONE AND PEASLEY LIMESTONE, UNDIVIDED (Cambrian)--Chiefly medium- to light gray thick-bedded to massive locally dolomitic limestone, commonly containing small blebs and rods of white calcite or dolomite. Lower one-third of this map unit is blue-gray in color and contains zones of fairly abundant oolites and pisolites, and probably represents the Peasley Limestone. Basal beds grade downward into underlying Chisholm Shale. Thickness about 250 m

ϵc CHISHOLM SHALE (Cambrian)--Throughout all of its exposures in The Tetons quadrangle and in the adjacent Blue Mountain quadrangle (Weaver, 1980), the Chisholm Shale has acted as the slip plane of the Blue Mountain thrust plate, and consequently is highly sheared and deformed. Generally it is a micaceous olive-green shale containing thin interbeds of oolitic or pisolitic blue-gray to dark-gray silty or sandy limestone. Regionally the Chisholm averages about 30 m in thickness, but in The Tetons quadrangle the exposures range from a meter or so to about 50 m

ϵh HOWELL LIMESTONE (Cambrian)--A dragged slab of light-gray micritic limestone below the Chisholm Shale within the zone of the Blue Mountain thrust fault is believed to be from the Howell Limestone. This displaced slab has a maximum thickness of about 30 m

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EXPLANATION OF MAP SYMBOLS

CONTACT--Dashed where approximately located or inferred

HIGH-ANGLE FAULT--Dashed where approximately located or inferred; dotted where concealed; bar and ball on relatively downdropped side

THRUST FAULT--Saw teeth on side of upper plate; dotted where concealed

STRIKE AND DIP OF BEDS

Inclined

Horizontal

Vertical

STRIKE AND DIP OF FOLIATION

Inclined

Horizontal

Vertical

MINE SHAFT

MINE ADIT

PROSPECT PIT

Note: A printed list of commonly used map symbols is available on request from the Director, U.S. Geological Survey, Reston, VA 22092.