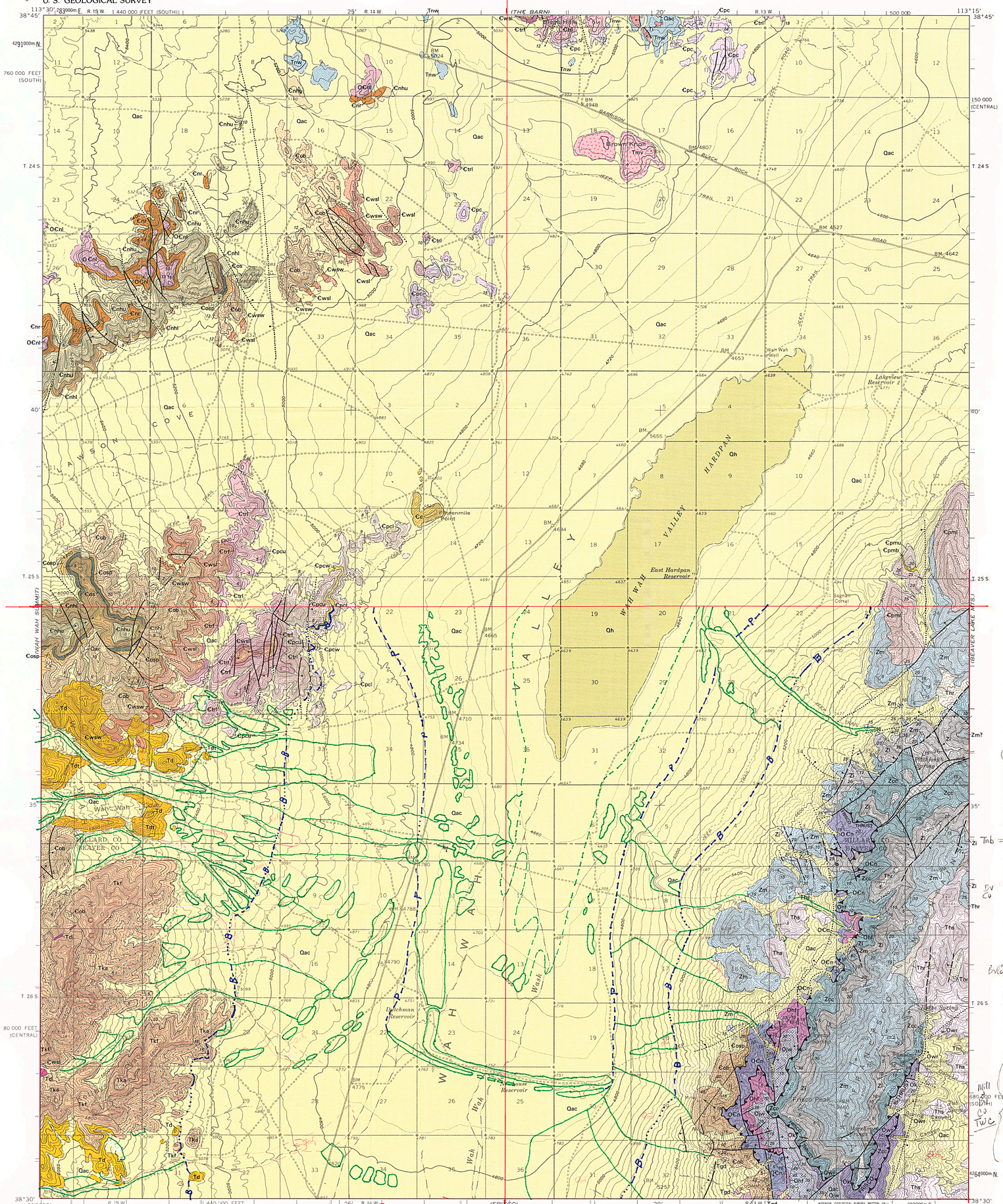
I-1573

DEPARTMENT OF THE INTERIOR
U. S. GEOLOGICAL SURVEY

MISCELLANEOUS INVESTIGATIONS SERIES
MAP I-1573



CORRELATION OF MAP UNITS

Qh, Qac	Holocene	QUATERNARY
Ti, Tgd, Tnw, Tmv, Tdi, Tka, Tkf, Td, Tdt, Ths, Thr	Holocene and Pleistocene	QUATERNARY
	Oligocene	TERTIARY
Unconformity		
Owr	Middle Ordovician	ORDOVICIAN
Ok, Ojw, Ohf, OCn	Lower Ordovician	ORDOVICIAN
Cosp, Cob	Upper Cambrian	CAMBRIAN
Cpc (Cpcu, Cpcw, Cpcl, Ce)	Middle Cambrian	CAMBRIAN
Cpmu, Cpmb, Cpml	Lower Cambrian	CAMBRIAN
Zm, Zi, Zcc		LATE PROTEROZOIC

UPPER PLATE OF WAH WAH THRUST[1]: OCnl, Cnr, Cnhu, Cnhl, Cos

LOWER PLATE OF FRISCO THRUST: Owr, Ok, Ojw, Ohf, OCn

UPPER PLATE OF FRISCO THRUST: Cpmu, Cpmb, Cpml

[1] The Frisco and Wah Wah thrust plates appear to be parts of the same general thrust plate, but the Wah Wah thrust fault is exposed in Rose Spring Canyon 40 km southwest of Frisco Peak and is believed to underlie the central and northern Wah Wah Mountains. The Frisco thrust, in comparison, underlies the central and northern parts of the adjacent Frisco Mountains.

DESCRIPTION OF MAP UNITS

Qh HARDPAN (HOLOCENE)—White to creamy-tan playa deposits in Wah Wah Valley consisting predominantly of silt, calcium carbonate, sodium chloride, and other evaporitic salts. Thickness unknown but probably about a meter

Qac ALLUVIUM AND COLLUVIUM (HOLOCENE AND PLEISTOCENE)—Unconsolidated and semiconsolidated talus, stream, and floodplain deposits in mountains, and semiconsolidated pediment gravel, fanglomerate, and basin-fill deposits in valleys. Total thickness locally exceeds 1,000 m

Ti ISOM FORMATION (OLIGOCENE)—Black to medium-brown vitrophyre 1-2 m thick overlain by brown, densely welded, vuggy, ash-flow tuff less than 10 m thick. Streaked appearance on freshly broken surfaces. Contains about 10 percent phenocrysts of sanidine, andesine, quartz, and biotite. Exposures in Frisco Peak quadrangle probably represent the northernmost occurrence of Isom Formation. Total thickness about 10 m

Tgd GRANODIORITE OF CACTUS STOCK AND ASSOCIATED INTRUSIVE BODIES (OLIGOCENE)—Pinkish- or lavender-gray, medium-grained, granitic rock that forms northernmost part of Cactus stock and associated dikes and minor plutons. Exposed mainly in Frisco quadrangle to the south. Freshest rocks contain medium-sized phenocrysts of perthitic orthoclase, oligoclase-andesine, quartz, hornblende, biotite, and, locally, diopsidic augite. Accessory minerals include apatite, zircon, sphene, rutile, and abundant magnetite. Biotite from exposures of granodiorite at portal of Cactus mine in adjacent Frisco quadrangle yielded a K-Ar age of 28.0 m.y. according to Lemmon, Silberman, and Kistler (1973, p. 24)

Tnw WAH WAH SPRINGS MEMBER OF NEEDLES RANGE FORMATION (OLIGOCENE)—Reddish-brown to dark-lavender, strongly welded tuff. Phenocrysts moderately abundant and consist of plagioclase, hornblende, and biotite; accessory minerals include magnetite, green augite, and quartz. Thickness probably 30-40 m

Tmv MAFIC VOLCANIC ROCKS (OLIGOCENE)—Dark-gray, brown-weathering lava flows considerably broken by wave action of Pleistocene Lake Bonneville. Typical specimens contain about 10 percent phenocrysts of plagioclase, black augite, and reddish-brown olivine in a fine-grained matrix. Identical rock interlayered between Cottonwood Wash and Wah Wah Springs Tuff Members of Needles Range Formation in Barn quadrangle to the north. Thickness probably less than 20 m

Tdi DIORITE INTRUSIVE BODIES (OLIGOCENE)—Gray to brownish-gray, medium-grained, porphyritic intrusive rocks containing andesine, orthoclase, hornblende, biotite, and minor quartz and augite. Accessory minerals include abundant magnetite, apatite, zircon, and ilmenite. A pluton, whose eastern tip is exposed here, is the easternmost of three intrusive bodies that form an east-trending line through the central part of the Wah Wah Mountains

ANDESITE OF KELLEYS PLACE (OLIGOCENE)—Thick pyroclastic deposits containing two or more flows of dark volcanic rocks in southwestern corner of quadrangle. Probably eruptive equivalents of diorite intrusive bodies (Tdi)

Tka Agglomerate member—Medium-grained to very coarse grained, crudely stratified, andesite agglomerate. Clasts moderately well rounded and range in size from blocks 1-2 m in diameter to lapilli; embedded in heterogeneous matrix of gray to pink volcanic ash. Thickness about 500 m

Tkf Flow units—Dark-brown, fine- to medium-grained, porphyritic andesite composed of phenocrysts of andesine, biotite, and hornblende in a dense, felted matrix. Hornblende separated from fresh samples of upper of two main flow units yielded a K-Ar age of 32.5 m.y. according to Lemmon, Silberman, and Kistler (1973, p. 25). Thickness of each individual flow unit about 50 m

DACITE OF WAH WAH COVE (OLIGOCENE)—Gray, porphyritic, dacite to rhyodacite flow rocks in Wah Wah Cove area in west-central part of Frisco Peak quadrangle. Commonly underlain by a light- to medium-gray dacitic tuff. Tuff unit rests directly on an erosion surface cut on Cambrian sedimentary rocks

Td Dacite flow member—Crops out in two areas, one near Wah Wah Cove and the other near Kelleys Place. In Wah Wah Cove area flow rocks chiefly medium- to dark-gray, dense, dacite porphyry with some zones of flow breccia and vitrophyre near base. Phenocrysts consist of andesine, biotite, and hornblende. According to Lemmon, Silberman, and Kistler (1973, p. 25), biotite from specimens near base of flows yielded a K-Ar age of 33.6 m.y. In the vicinity of Kelleys Place, dacitic flow rocks fine- to medium-grained, relatively massive, faintly flow banded dacite and rhyodacite containing prominent small- to medium-sized phenocrysts of andesine, hornblende, biotite, and quartz. These rocks believed to be somewhat higher in volcanostratigraphic succession than those near Wah Wah Cove. Plagioclase separated from fresh samples of dacitic flow rocks near Kelleys Place contains greater than 1 percent K_2O and yielded a K-Ar age of 33.1 m.y. according to Lemmon, Silberman, and Kistler (1973, p. 25). Total thickness of dacitic flow rocks apparently exceeds 350 m

Tdt Dacite tuff member—Dacitic flow rocks near Wah Wah Cove (Td) underlain by white to light-gray and reddish-gray, massive, lapilli tuff containing fragments of porphyritic dacite, white pumice, and broken crystals of biotite and andesine in a faintly banded matrix of vitric ash. Some exposures of massive tuff show cavernous weathering features. Thickness exceeds 100 m

Ths HORN SILVER ANDESITE OF STRINGHAM (1967)(OLIGOCENE)—Heterogeneous, medium-gray to reddish-, purplish-, or greenish-gray, medium-grained, eruptive rocks ranging in composition from andesite to dacite and quartz latite. Greater part of formation consists of medium- to thick-bedded, porphyritic flow rocks, but also contains lenses of intraformational tuff, breccia, agglomerate, and conglomerate. Phenocrysts of flow units include andesine, conspicuous hornblende, biotite, augite, quartz, and abundant magnetite and other accessory minerals. Andesite appears to be oldest volcanic unit in San Francisco Mountains and overlies either a prelava conglomeratic rubble deposit or an erosion surface carved on Paleozoic or Precambrian sedimentary strata. According to Lemmon, Silberman, and Kistler (1973, p. 24-25), minerals from a sample of porphyritic pyroxene-hornblende-biotite andesite vitrophyre from southwestern corner of Beaver Lake Mountains quadrangle, about 2 km east of southeastern corner of Frisco Peak quadrangle, yielded isotopic ages of 30.8 m.y. (plagioclase) and 34.1 m.y. (hornblende). Total thickness of the Horn Silver Andesite is unknown, but a diamond drill hole about 1.7 km south of Golden Reef mine in southeastern part of quadrangle penetrated 310 m of the unit and did not cut the base

Thr CONGLOMERATE OF HIGH ROCK PASS (OLIGOCENE)—Heterogeneous conglomerate containing pebbles, cobbles, and boulders of limestone, quartzite, and other sedimentary rocks embedded in a matrix of red-weathering, fine-grained siltstone or sandy shale. Represents soil and rubble zone that irregularly covered sedimentary rocks at time of first volcanic eruptions in area that is now the San Francisco Mountains region, and compositionally reflects lithologic makeup of local bedrock. Named from exposures near High Rock Pass in adjacent Beaver Lake Mountains quadrangle. Thickness ranges from a few centimeters to more than 50 m

LOWER PLATE OF FRISCO THRUST

Owr WATSON RANCH QUARTZITE (MIDDLE ORDOVICIAN)—Massive, buff, white or light-gray, medium-grained quartzite. Identification as Watson Ranch Quartzite based on exposures near Imperial mine in adjacent Frisco quadrangle. Section incomplete due to removal of upper part by thrust faulting; exposed portion about 100 m thick

POGONIP GROUP (MIDDLE AND LOWER ORDOVICIAN)—Includes Kanosh Shale through House Limestone

Ok KANOSH SHALE (MIDDLE ORDOVICIAN)—Dark-brownish-green to olive-gray, moderately fissile shale with local interbeds of thin-layered fossiliferous limestone and, in upper half, yellowish-brown siltstone. Average thickness where undisturbed by thrust faulting about 40 m

Ojw JUAB (MIDDLE ORDOVICIAN) AND WAH WAH (LOWER ORDOVICIAN) LIMESTONES, UNDIVIDED—Moderately to weakly contact-pyrometasomatized limestone. Upper part granular and arenaceous; lower part silty and locally fossiliferous. Thickness about 110 m, but section may be incomplete due to complex folding and thrust faulting

Ohf FILLMORE FORMATION AND HOUSE LIMESTONE, UNDIVIDED (LOWER ORDOVICIAN)—Moderately to weakly contact-pyrometasomatized, locally highly contorted, and thrust-faulted limestone. Upper two-thirds is thin-bedded silty limestone consisting largely of calcareous intraformational conglomerate, and lower one-third medium- to thick-bedded, dense, locally cherty limestone. Total thickness about 200 m, but an unknown part of House Limestone has been cut out by thrust faulting near base

OCn NOTCH PEAK FORMATION (LOWER ORDOVICIAN AND UPPER CAMBRIAN)—Moderately to weakly contact-pyrometasomatized, thick-bedded to massive, sparsely cherty dolomite or dolomitic limestone. Some beds algal stromatolites. Locally, section incomplete due to thrust faulting; maximum exposed portion about 250 m thick

ORR FORMATION (UPPER CAMBRIAN)

Cosp Steamboat Pass Shale Member—Weakly hornfelsed, dark-brown to olive-green, thin-bedded to fissile shale; locally contains thin interbeds of blue-gray limestone in upper part. Unaltered shale commonly contains trilobites. In exposures in the San Francisco Mountains the Sneakover Limestone Member that normally overlies this member is not present either because of nondeposition, or because it was cut out by a thrust fault parallel to bedding. Thickness of exposed section of Steamboat Pass Shale Member 35 m, but may be thinned or locally cut out by thrust faulting

Cob Big Horse Limestone Member—Medium- to thick-bedded, mottled and striped, granular limestone. Altered near Cactus stock and progressively bleached and marbelized near intrusive contact. Base of member not exposed, but partial section about 280 m thick

UPPER PLATE OF WAH WAH THRUST

NOTCH PEAK FORMATION

OCnl Limestone member of Lava Dam (Lower Ordovician and Upper Cambrian)—Medium- to dark-gray, silty and shaly limestone containing a few thin beds of intraformational conglomerate. Uppermost 7-10 m contains 30 percent brown chert; balance of formation sparsely cherty. *Eurekia-Euptychaspis* trilobite fossils common about 40 m above base. Thickness about 105 m

Cnr Calcarenite member of Red Tops (Upper Cambrian)—Bench-forming, medium-gray, thin- to medium-grained, organic-detrital limestone; contains conodonts and trilobites. Thickness 15-50 m

Cnhu Member of Hell'n Maria Canyon (Upper Cambrian)
Upper part—Mostly dark-brownish-gray dolomite in lower third and dark-brownish-gray dolomite alternating with light-brownish-gray dolomite and medium-gray limestone in upper two-thirds of unit. In general, thick-bedded to massive, medium to coarsely crystalline, and contains about 5 percent dark-gray chert nodules. Silicified *Matthevia* and *Matherella* abundant about 100-125 m below top of unit. Total thickness about 275 m

Cnhl Lower part—Massive, medium-gray, unfossiliferous limestone. Thickness about 135 m

ORR FORMATION (UPPER CAMBRIAN)

Cos Sneakover Limestone Member—Medium-gray, medium- to thick-bedded, silty limestone interlayered with beds of shale, shaly limestone, and organic-detrital limestone. Thickness about 60 m

Cosp Steamboat Pass Shale Member—Olive-green, fissile shale with about 50 percent interlayered, thin-bedded, fossiliferous limestone in upper half and mostly thin-bedded nodular limestone with minor shale layers in lower half. Contains the *Dicanthopyge*, *Prehousia*, *Dunderbergia*, and lower *Elvinia* trilobite zones of Palmer (1965). Thickness about 809 m

Cob Big Horse Limestone Member—Medium- to dark-gray, mottled and striped, granular limestone with some beds of oolitic limestone and organic-detrital limestone containing trilobite fragments in upper half. According to Hintze (1974), trilobite fossils belong to upper *Crepicephalus* zone. Thickness about 245 m

FORMATION OF WAH WAH SUMMIT (UPPER CAMBRIAN)

Cwsw White marker member—Very light gray, finely crystalline, laminated limestone weathering light brownish gray. Forms a conspicuous white band across sparsely covered bedrock slopes. Thickness about 50 m

Cwsl Ledgy member—Medium- to light-gray, medium- to coarse-grained, granular limestone. Contains 2 percent bedded chert nodules in upper half of member and dolomitic zones in lower third. Thickness about 170 m

TRIPPE LIMESTONE (MIDDLE CAMBRIAN)

Ctrf Fish Springs Member—Thin-bedded, shaly and silty limestone with a few thin layers of flat-pebble conglomerate containing *Eldoradia* fragments. Thickness about 40 m

Ctrl Lower member—Alternating bands of light-gray, laminated dolomite and dark-gray, mottled dolomitic limestone 1-15 m thick. Light-gray laminated bands conspicuous, but make up only about 25 percent of member. Thickness about 155 m

PIERSON COVE FORMATION (MIDDLE CAMBRIAN)—Similar in general appearance to lower member of Trippe Limestone but contains a much higher proportion of dark-gray, mottled, dolomitic limestone

Cpcu Upper member—Mostly dark-gray, thick-bedded to massive, cliff-forming, dolomitic limestone with a zone of medium-bedded, light-gray dolomite 25 m thick about 70 m above base. Total thickness about 200 m

Cpcw White member—Light-yellowish-gray, laminated dolomite and limestone about 12 m thick

Cpcl Lower member—Upper three-fifths dark-gray, massive, cliff-forming dolomite; lower two-fifths chiefly medium-gray, thin- to medium-bedded limestone and dolomite. Total thickness about 160 m

Cpc PIERSON COVE FORMATION, UNDIVIDED—Dark-gray, massive, granular, dolomitic limestone of unknown member designation

Ce EYE OF NEEDLE LIMESTONE OF HINTZE AND ROBISON (1975) (MIDDLE CAMBRIAN)—Light-gray, thick-bedded to massive, very fine grained limestone that commonly forms knobs and cliffs. Thickness about 60 m

UPPER PLATE OF FRISCO THRUST

PROSPECT MOUNTAIN QUARTZITE (LOWER CAMBRIAN)

Cpmu Upper member—Chiefly pinkish- to light-brownish-gray, medium-bedded, medium-grained, faintly crossbedded quartzite. Some scattered beds of fine- to medium-grained conglomerate. Exposures in northern part of the Frisco Mountains indicate a thickness of 1,770 m

Cpmb Basalt member—Dark-gray to bluish-black, chloritized basalt or greenstone containing a few amygdules in upper part. Thickness 1-15 m

Cpml Lower member—White to pink-, medium- to coarse-grained, moderately conglomeratic quartzite. Lowest beds poorly sorted and gritty, and commonly weather brown to reddish brown. Beds of true conglomerate are common in lower third of member, but pebbles rarer in overlying beds. Pink feldspar fragments also common throughout lower member and locally constitute 10 percent of some beds. Base of formation is apparently concordant, but everywhere sharp and well defined by a basal conglomerate. Thickness about 520 m

Zm MUTUAL FORMATION (LATE PROTEROZOIC)—Pink to dark-purplish-red, coarse-grained, pebble-streaked, medium-bedded, mostly coarse-grained quartzite; many layers crossbedded. Locally, contains beds of purple or silver-gray phyllitic argillite, particularly near middle of formation. Near some faults, purple beds bleached to buff or grayish white. Thickness about 550 m

Zi INKOM FORMATION (LATE PROTEROZOIC)—Purplish-red, arenaceous, phyllitic argillite with sparse thin beds of green and purple, medium-grained, micaceous quartzite, and purple siltstone. Thickness about 140 m

Zcc CADDY CANYON QUARTZITE (LATE PROTEROZOIC)—Buff, light-pink, or white, fine- to medium-grained, medium- to thick-bedded quartzite. Uppermost part of formation medium- to dark-brown, gritty quartzite locally containing lenses and scattered pebbles of white quartz. Base of formation cut out by Frisco thrust, but exposed section about 80 m thick

CONTACT—Dashed where approximately located

HIGH-ANGLE FAULT—Dashed where inferred; dotted where concealed. Bar and ball on downthrown side

THRUST FAULT—Dotted where concealed. Sawteeth on upper plate

SHEAR ZONE—Characterized by angular tectonic breccia

STRIKE AND DIP OF LAYERED ROCKS—Includes both sedimentary and tuffaceous igneous rocks

AXIS OF ANTICLINE

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Base from U.S. Geological Survey 1:62,500, 1980
10,000-foot grid based on Utah coordinate system, central and south zones
1000-meter Universal Transverse Mercator grid ticks, zone 12

SCALE 1:48 000
1 ½ 0 1 2 3 MILES
1 .5 0 1 2 3 KILOMETERS
CONTOUR INTERVAL 40 FEET
DOTTED LINES REPRESENT 20-FOOT CONTOURS
NATIONAL GEODETIC VERTICAL DATUM OF 1929

TRUE NORTH
GRID NORTH
MAGNETIC NORTH
APPROXIMATE MEAN DECLINATION, 1984

QUADRANGLE LOCATION

INTERIOR—GEOLOGICAL SURVEY, RESTON, VA—1984—G83080

Geologic mapping by D. M. Lemmon, 1958–1964; L. F. Hintze, 1971, and members of the Brigham Young University Field Camps, 1959 and 1971; and H. T. Morris and R. W. Kopf, 1978 and 1980.

GEOLOGIC MAP OF THE FRISCO PEAK QUADRANGLE, MILLARD AND BEAVER COUNTIES, UTAH

By
L. F. Hintze, D. M. Lemmon, and H. T. Morris

1984

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