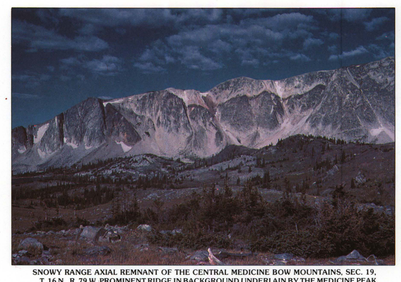
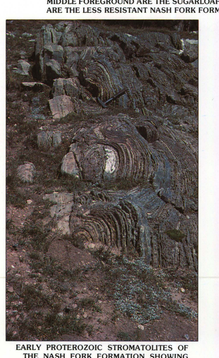
U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

MISCELLANEOUS INVESTIGATIONS SERIES
MAP I–2280
Pamphlet accompanies map

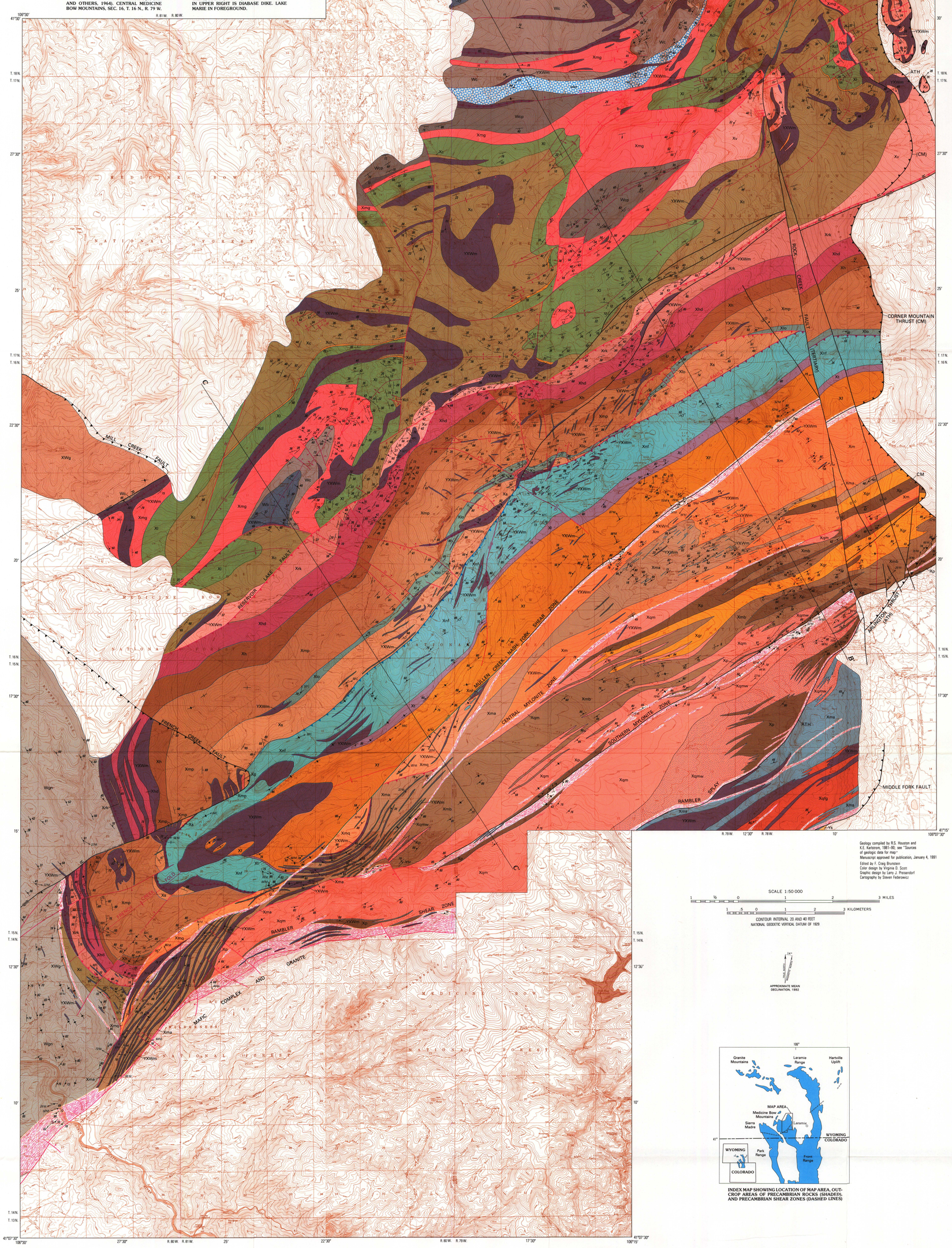


SNOWY RANGE AXIAL REMNANT OF THE CENTRAL MEDICINE BOW MOUNTAINS, SEC. 19, T. 16 N., R. 79 W. PROMINENT RIDGE IN BACKGROUND UNDERLAIN BY THE MEDICINE PEAK QUARTZITE WHICH IS INTRUDED BY DIABASE DIKES (DARK BANDS). WHITE BEDS IN MIDDLE FOREGROUND ARE THE SUGARLOAF QUARTZITE. GRAY BEDS IN FOREGROUND ARE THE LESS RESISTANT NASH FORK FORMATION.



EARLY PROTEROZOIC STROMATOLITES OF THE NASH FORK FORMATION SHOWING LATERALLY LINKED HEMISPHEROIDS (LOGAN AND OTHERS, 1964). CENTRAL MEDICINE BOW MOUNTAINS, SEC. 16, T. 16 N., R. 79 W.

RESISTANT RIDGE OF MEDICINE PEAK QUARTZITE OF THE CENTRAL MEDICINE BOW MOUNTAINS, SEC. 24, T. 16 N., R. 80 W. DARK BAND IN UPPER RIGHT IS DIABASE DIKE. LAKE MARIE IN FOREGROUND.



Base from U.S. Geological Survey, 1:24,000
Arlington, White Rock Canyon, 1958; Centennial, Keystone, Medicine Bow Peak, Morgan, Overlook Hill, Phantom Lake, Sand Lake, Turpin Reservoir, 1961

Geology compiled by R.S. Houston and K.E. Karlstrom, 1981–89; see "Sources of geologic data for map"
Manuscript approved for publication, January 4, 1991
Edited by F. Craig Brunstein
Color design by Virginia D. Scott
Graphic design by Larry J. Preisendorf
Cartography by Steven Federowicz

SCALE 1:50 000

CONTOUR INTERVAL 20 AND 40 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

APPROXIMATE MEAN DECLINATION, 1992

INDEX MAP SHOWING LOCATION OF MAP AREA, OUTCROP AREAS OF PRECAMBRIAN ROCKS (SHADED), AND PRECAMBRIAN SHEAR ZONES (DASHED LINES)

CORRELATION OF MAP UNITS

Unit	Age in million years	Group	Period	Era
Ys	1,415–1,435		MIDDLE PROTEROZOIC	PROTEROZOIC
Xqm, Xqmw, Xgr, Xmb, Xp, Xqfg, Xms, Xma, Xm, Xmq		Relations uncertain		
Suture and (or) major fault system				
Xf, Xt, Xnf		Upper part, Libby Creek Group	EARLY PROTEROZOIC	
Fault				
Xg	1,900–2,150			
Xs, Xlo, Xmp, Xh, Xhd		Lower part, Libby Creek Group		
Unconformity				
Xrk				
Fault				
Xv		Deep Lake Group		
Unconformity				
Xc				
Unconformity				
Xcl				
Unconformity				
Xl				
Xmg				
Major Unconformity				
XWg	2,430–2,683		EARLY PROTEROZOIC OR LATE ARCHEAN	PROTEROZOIC OR ARCHEAN
Wcp, b, Wc, Wb, Wrm, Wsc, Woc		Phanton Lake Metamorphic Suite; Relations uncertain	LATE ARCHEAN	ARCHEAN
Unconformity				
Wgn	>2,683			

DESCRIPTION OF MAP UNITS

Ys **Sherman Granite (Middle Proterozoic)**—Pink, coarse-grained to pegmatitic microcline granite. Exposed in the extreme southeastern part of map area. Dated by uranium-lead zircon method as 1,415–1,435 Ma (Aleinikoff, 1983)

YXWm **Mafic intrusive rocks (Early Proterozoic to Late Archean)**—Gabbroic sills and dikes metamorphosed to varying degree but with many diabasic and gabbroic textures preserved. Most large bodies are quartz gabbro and norite, whereas smaller dikes and sills are basalt and diabase. Many, perhaps most, mafic intrusions are emplaced in faults, which are recognized at the extremity of the intrusion or are inferred to be faults because of inclusions of fault breccia in the intrusions. Mafic intrusions probably range in age from Late Archean to Early Proterozoic, but none have been dated by isotope methods

Xqm **Quartz monzonite gneiss (Early Proterozoic)**—Mostly pink or buff to gray, medium- to coarse-grained gneiss composed of nearly equal amounts of quartz, potash feldspar, and plagioclase. Locally includes bodies of nonfoliated granite, alaskite, quartz monzonite, and pegmatite

Xqmw **Alaskitic facies**

Xgr **Pink gneissic granite (Early Proterozoic)**—Pink gneissic granite having gradational contacts with migmatitic biotite schist and gneiss

Xmb **Migmatitic biotite schist and gneiss (Early Proterozoic)**—Coarse-grained, migmatitic, sillimanite-garnet-biotite schist and gneiss and weakly foliated biotite augen gneiss. Melanosome is map unit Xp, which is intruded or engulfed by granitic and granodioritic components. The granitic and granodioritic component is 30–70 percent of unit. Where granitic and granodioritic component is abundant, it has a granitoid texture and contains euhedral and zoned plagioclase

Xp **Pelitic schist and gneiss (Early Proterozoic)**—Dark-gray to black, medium- to coarse-grained, biotite-quartz-feldspar schist and gneiss with lesser amounts of fine-grained quartz-biotite schist and gneiss. Unit is weakly foliated; with increasing feldspar the biotite-quartz-feldspar schist grades into a crudely layered, coarse-grained gneiss having a granitoid texture. The unit is commonly proto-mylonitic, and well-developed, narrow (<10 mm) mylonite zones are present in all rock types

Xqfg **Quartz plagioclase gneiss (Early Proterozoic)**—Chiefly pink to gray, fine- to medium-grained gneiss containing plagioclase, quartz, epidote, and biotite. Unit is compositionally diverse and is locally mylonitic

Xms **Mafic schist and gneiss (Early Proterozoic)**—Dark-gray to purple, fine- to coarse-grained, moderately to strongly foliated, hornblende-biotite-plagioclase schist and gneiss interlayered with a variety of calcium-rich rocks including marble, calcite-garnet-diopside-epidote schist, and diopside-hornblende-chlorite-calcite gneiss. This succession contains conformable amphibolite and felsic gneiss that are probably ortho-gneiss. Locally, amphibolite retains granitoid textures. This unit is interpreted as volcanogenic

Xma **Mylonitic biotite augen gneiss (Early Proterozoic)**—Dark-gray to black, medium-grained, moderately to strongly foliated, hornblende-bearing, biotite augen gneiss. Augen are elongate pink microcline porphyroblasts, 5–20 mm in maximum dimension. Unit is locally migmatitic and contains 10–50 percent concordant and discordant masses of pegmatite and coarse-grained gneissic granite. Unit also exhibits varying degrees of mylonitization expressed by reduction in grain size and coalescence of microcline augen into thin stringers. Zones of ductile deformation (mylonite) averaging 10 cm but ranging to as much as 1 m in width, parallel or cross-cut foliation at low angles

Xm **Mylonitic quartz-feldspar gneiss (Early Proterozoic)**—Layered gneiss, biotite-quartz-feldspar gneiss, and quartz-feldspar gneiss. Layered gneiss is fine to medium grained and consists of white to light-gray quartz-microcline (± plagioclase) layers that alternate with dark-gray biotite-plagioclase-epidote layers. Layers range in width from 5 to 30 mm and are characterized by sharp contacts. Rootless fold hinges suggest that layering results from transposition of an earlier S surface. Biotite-quartz-feldspar gneiss is medium to coarse grained, gray, weakly to well foliated and contains accessory hornblende, sphene, and epidote. Where foliation is not well developed, biotite-quartz-feldspar gneiss resembles a coarse-grained plutonic rock. Quartz-feldspar gneiss is fine to medium grained, pink, and leucocratic. It may be a weakly metamorphosed alkali feldspar granite intruded into the layered biotite-quartz-feldspar gneiss. Alternatively, it might be a neosome, and the layered and biotite-quartz-feldspar gneiss a paleosome of migmatite. All rocks in the unit show evidence of mylonitization, but widespread recrystallization has probably destroyed much of the mylonitized fabric (Duebendorfer, 1986)

Xmq **Mylonitic quartzite (Early Proterozoic)**—White to dark-blue layers. Where individual quartz grains can be recognized, they are flattened and stretched. The mylonitic quartzite is probably derived, in part, from the Medicine Peak Quartzite, but most of the quartzite is too deformed to ascertain its origin

Xf **French Slate of upper part of Libby Creek Group (Early Proterozoic)**—Gray to black slate and phyllite containing beds of hematitic quartzite. Laminae (probably original bedding) are defined by alternations of layers rich in muscovite, chlorite, and opaque minerals with layers rich in quartz. Metacrysts of biotite and pyrite are present locally. The French Slate is truncated at its top by a major fault. Laminae near the fault are crenulated and complexly folded and refolded. The unit is probably marine and may have been deposited in a forearc basin. The minimum thickness of the French Slate is 2,000 ft

Xt **Towner Greenstone of upper part of Libby Creek Group (Early Proterozoic)**—Green to purple, massive to schistose amphibolite of basaltic composition with thin beds of quartzite and very fine grained quartzite or metachert present locally. In the Towner Lake area, pillows are present in much of the unit. The Towner Greenstone is considered to be marine. Thickness 1,600 ft

Xnf **Nash Fork Formation of upper part of Libby Creek Group (Early Proterozoic)**—Tan metadolomite having thick intercalated lenses of black phyllite. Thin beds of interlayered quartzite, chert, flat-pebble conglomerate, and iron-formation are less common. The metadolomite is siliceous and is characterized by stromatolitic bioherms which have a variety of shapes and sizes. Black phyllite is locally graphitic and in some places is pyrite- and graphite-rich, constituting a sulfide facies iron-formation. Structures in the Nash Fork Formation include laterally linked hemispheroids and tabular oncolites. Plane-bedded metadolomite, interlayered with beds of bioherms, may exhibit crossbedding and have layers of flat-pebble conglomerate. These stromatolitic structures suggest shallow-water marine deposition. Thickness 6,500 ft

Xg **Gaps Intrusion (Early Proterozoic)**—Leucocratic, plagioclase-rich felsic igneous rock in association with gabbroic intrusive rocks emplaced in rocks of the lower part of the Libby Creek Group. Pink to gray, medium-grained rock having granitoid texture where undeformed. Most exposures show evidence of shearing and may be foliated or brecciated. Age determinations by the Rb-Sr whole-rock method suggest an age for the Gaps Intrusion of 1,900–2,150 Ma (Carl Hedge, written commun., 1980). Sheared Gaps Intrusion is radioactive and some sulfide-bearing quartz veins that cut the Gaps Intrusion contain as much as 1,000 ppm uranium and 1,655 ppm thorium

Xs **Sugarloaf Quartzite of lower part of Libby Creek Group (Early Proterozoic)**—White, medium-grained quartzite, better sorted and less feldspathic than underlying formations of the lower part of the Libby Creek Group. The dominant sedimentary structure is medium- to thin-bedded planar beds, but small-scale planar and trough crossbeds and symmetric, interference, and climbing ripples are common. Crossbedding indicates sediment transport toward the west-southwest. According to Karlstrom and others (1983), the Sugarloaf Quartzite was deposited in a shallow marine environment. Thickness 1,900 ft

Xlo **Lookout Schist of the lower part of Libby Creek Group (Early Proterozoic)**—Layered schist having alternating mica and quartz-rich layers, but phyllite and subarkosic, arkosic, and micaceous quartzite are abundant. Basal beds are graded and, locally, partial to complete Bouma units are preserved. Fine-grained arkosic quartzite exhibits small-scale planar crossbedding, hummocky cross-stratification, and climbing ripples; phyllite may have convolute structures. Sole marks have been identified at the base of Bouma units, and clastic dike swarms derived from quartzite are common in phyllite and layered schist. Magnetite-rich quartzite is present near the base, especially in exposures east of Lookout Lake. The magnetite may be detrital. The presence of both proximal and distal Bouma units as well as the abundance of soft-sediment structures suggests that the Lookout Schist was deposited from turbidity currents, perhaps as a result of slumping on a delta-front slope. Because it is more highly deformed than other formations of the lower part of the Libby Creek Group (with development of complex folds and several S surfaces), the primary structures described above are only preserved in local areas; some of the best exposures are east and west of Lewis Lake and near Telephone Lakes where the Lookout Schist is 1,186 ft thick

Xmp **Medicine Peak Quartzite of lower part of Libby Creek Group (Early Proterozoic)**—Massive, medium- to coarse-grained, white to bluish-gray quartzite containing distinctive beds of quartz-pebble conglomerate as much as 6 ft thick. Emerald-green, fuchsite-bearing layers as much as 56 ft thick are present near the top of the Medicine Peak Quartzite, but these layers are discontinuous. The upper 770 ft of the unit is coarse-grained, massive quartzite successions marked by planar crossbeds that are about 100 ft thick that alternate with quartzite successions about 120 ft thick containing beds of quartz-pebble conglomerate. Some quartz-pebble conglomerate layers are distinctive dark-blue to purple hematitic conglomerate layers as much as 1 ft thick; one bed about 400 ft below the top of the unit can be traced for 5.5 mi. Some of the quartz-pebble conglomerate beds near the top of the unit are fuchsite bearing and are locally radioactive, containing as much as 28 ppm uranium and 328 ppm thorium. Below these units is 1,130 ft of coarse- to very coarse grained quartzite containing scattered quartz pebbles and local quartz-pebble layers. Large-scale, low-angle, planar crossbeds can be recognized in some parts of this coarse-grained quartzite. Below this succession is about 2,500 ft of white, massive quartzite containing scattered quartz pebbles as much as 3 cm in diameter. Quartz-pebble conglomerate layers are uncommon and discontinuous; large-scale planar crossbeds can be identified in some layers. Below the quartzite is 360 ft of fining upwards sets having quartz-pebble conglomerate at its base, and below these sets is a 312 ft succession of medium- to coarse-grained quartzite consisting of a series of fining-upward sets overlain by very coarse grained quartzite having large-scale, planar crossbeds. The lower 200 ft of the Medicine Peak Quartzite is coarse- to very coarse grained, crossbedded quartzite, which exhibits a bluish-gray color due to the presence of kyanite. Throughout the unit, paleocurrent measurements suggest sediment transport to the southwest. The unit is interpreted (Karlstrom and others, 1983) to be mostly marine and may be part of a deltaic succession that also includes the Heart Formation and Lookout Schist. Thickness 4,350–6,000 ft

Xh **Heart Formation of lower part of Libby Creek Group (Early Proterozoic)**—Three-fold succession consisting of an upper quartzite, a middle phyllite, and a lower quartzite. The upper quartzite is tan, arkosic, and medium grained. Primary structures are uncommon in the upper quartzite. The middle phyllite is layered and consists of feldspar, chlorite, biotite, quartz, and muscovite. It is continuous in the northeast, but discontinues to the southwest. The lower quartzite is similar to the upper quartzite except that it has abundant primary structures including small-scale planar and trough crossbedding, interference ripples, climbing ripples, and ball and pillow structures; it is more massive and finer grained to the northeast. According to Flurkey (1983) the Heart Formation may represent a change from a glaciomarine environment, represented by the underlying three units, to a shallow marine, perhaps deltaic, environment laid down during glacial retreat. Thickness about 2,200 ft

Xhd **Headquarters Formation of lower part of Libby Creek Group (Early Proterozoic)**—Upper part is layered phyllite; lower part consists of interlayered paraconglomerate, quartzite, and schist. The upper layered phyllite is a chlorite-biotite-quartz phyllite that contains alternating quartz-rich and mica-rich layers. Near its contact with the Heart Formation it is characterized by climbing ripples. The lowermost bed is a paraconglomerate containing subrounded to subangular clasts of granite, quartzite, and schist in a matrix of sand and silt-size fragments of quartz, potash feldspar, plagioclase, rock, and mica. The matrix of the paraconglomerate is typically massive or faintly stratified, but some layers are laminated and some show Bouma sets. Dropstones have been identified in the paraconglomerate (Sylvester, 1973). Quartzite interlayered with the paraconglomerate is plagioclase arkose and is characterized by small-scale planar and trough crossbedding. The Headquarters Formation is interpreted as glaciomarine (Houston and others, 1981). Thickness about 2,100 ft

Xrk **Rock Knoll Formation of lower part of Libby Creek Group (Early Proterozoic)**—Gray, medium-grained arkose containing phyllitic partings as much as 1 ft thick and paraconglomerate layers as much as 3 ft thick. As in parts of the Vagner Formation and in all rocks of the lower part of Libby Creek Group, the Rock Knoll feldspar is chiefly plagioclase. Clasts in the paraconglomerate are quartz, quartzite, and granite. The unit is about 1,250 ft thick, but its true thickness is unknown because the lowest exposed part of the formation is in fault contact with older rocks

Xv **Vagner Formation of Deep Lake Group (Early Proterozoic)**—Paraconglomerate, marble, phyllite, and quartzite. Complexly folded phyllitic quartzite is underlain by marble composed of intricately folded layers rich in calcite and quartz, which is, in turn, underlain by paraconglomerate. The phyllite is layered with alternate quartz-rich and mica-rich layers (varves?). The paraconglomerate matrix has the composition of subarkose and contains angular to subrounded variably sized clasts of granite, quartzite, and schist. Dropstones, poor sorting, subangular clasts of the paraconglomerate, fine laminations of the phyllite, and the lateral persistence of the interbedded marble suggests glaciomarine deposition (Sylvester, 1973). Varies in thickness but is as much as 2,600 ft thick

Xc **Cascade Quartzite of Deep Lake Group (Early Proterozoic)**—White, well-sorted, pebbly quartzite and subarkose with interbedded quartz and black chert-pebble conglomerate in layers 5–10 cm thick. Planar and trough crossbedding is common and paleocurrent measurements taken on those directional structures indicate southwest directed current flow. The unit is thick (as much as 2,800 ft), but it is locally thinned by erosion of upper beds. The environment of deposition may be fluvial or marine deltaic or may perhaps contain elements of both

Xcl **Campbell Lake Formation of Deep Lake Group (Early Proterozoic)**—Upper part is quartz-rich phyllite and lower part is paraconglomerate. Upper phyllite is black to gray, rich in quartz, and locally crossbedded up-section. The lower paraconglomerate is 80 percent matrix that is composed of quartz with lesser amounts of plagioclase and mica and minor rock fragments. Clasts are white granite, phyllite, and quartzite and show large variation in diameter from 2 to 76 cm. The clasts are rounded to subangular. Campbell Lake Formation is discontinuous and ranges in thickness from 0 to 205 ft

Xl **Lindsey Quartzite of Deep Lake Group (Early Proterozoic)**—White to gray quartzite and subarkose; typically medium grained with thin phyllitic layers and partings. Crossbedding is well preserved and ripple marks have been identified locally. Pebbles are present along planar foreset beds and in small scours. Paleocurrent distribution is strongly unimodal with a transport direction to the southwest. Thickness about 1,350 ft. It is interpreted as a fluvial deposit and may have been deposited in braided streams in a more distal environment than beds of the underlying Magnolia Formation

Xmg **Magnolia Formation of Deep Lake Group (Early Proterozoic)**—Consists of a coarse-grained arkosic quartzite (quartzite member of Karlstrom and Houston, 1979) that overlies a discontinuous basal conglomerate (conglomerate member of Karlstrom and Houston, 1979). The arkosic quartzite has abundant trough crossbeds and local thin beds of quartz-pebble conglomerate that together constitute fining-upward sets. The unit is continuous throughout the map area. It overlies beds of radioactive quartz-pebble conglomerate that grade up-section into coarse-grained micaceous quartzite. The quartz-pebble conglomerate is best developed in the northeast. Uranium is leached from surface outcrops of quartz-pebble conglomerate but subsurface samples contain as much as 1,620 ppm uranium, and many beds of quartz-pebble conglomerate, which average over 2 m in thickness, contain over 100 ppm uranium. The lowermost beds of this unit are paraconglomerate containing clasts of quartzite, schist, mafic volcanic rocks, and, locally, granite in a matrix of micaceous arkose and subarkose. The paraconglomerate is radioactive (as much as 50 ppm uranium and 200 ppm thorium in the south and as much as 176 ppm uranium and 915 ppm thorium in the northeast). The Magnolia Formation varies in thickness but averages about 1,200 ft. According to Karlstrom and others (1981) it is braided stream and river deposits, perhaps including alluvial fan deposits at the base

XWg **Pink granite (Early Proterozoic or Late Archean)**—Pink foliated granite typically concordant in structure to country rock; locally exhibits gradational contacts with quartzofeldspathic gneiss, with or without augen transitional phase. Locally, massive phases of pink granite cut country rock. Rocks mapped as pink granite include granite, granodiorite, quartz monzodiorite, and trondhjemite. Pink granite of the northern Medicine Bow Mountains has not been dated, but similar granite exposed in the western Medicine Bow Mountains and northeastern Sierra Madre have ages that range from Late Archean to Early Proterozoic. Premo (1983) dated a quartzo-feldspathic orthogneiss of the northeastern Sierra Madre having field and petrographic characteristics similar to the pink granite dated as 2,665±28 Ma and 2,683±5 Ma by U-Pb zircon method. The Baggot Rocks Granite of the western Medicine Bow Mountains, which also resembles the pink granite of this area, was considered to be Late Archean by Hills and others (1968) and by Hills and Houston (1979), although Rb-Sr whole-rock dates yielded a large enough uncertainty to allow an Early Proterozoic age. A new U-Pb zircon date from samples collected from the Baggot Rocks type locality yielded an age of 2,430±4 Ma (Premo and Van Schmus, 1989), suggesting that the pink granite of this locality is Early Proterozoic. The pink granite of the northern Medicine Bow Mountains is the only control we have on age of rocks of the Phantom Lake Metamorphic Suite of this area, and inasmuch as the age of the granite could be earliest Proterozoic, it leaves the question of age of the Phantom Lake Metamorphic Suite open. Rocks of the lower part of the Phantom Lake Metamorphic Suite are cut by granodiorite (dated as 2,710±12 Ma by the U-Pb zircon method, Premo and Van Schmus, 1989) in the northcentral Sierra Madre, and we thus class them as Archean in both the Sierra Madre and Medicine Bow Mountains

Wcp **Conical Peak Quartzite of Phantom Lake Metamorphic Suite (Late Archean)**—White, fine-grained micaceous subarkose containing beds of calcareous quartzite and metabasalt. Both large-scale planar and trough crossbeds common. Paleocurrent direction is bimodal

b **Metabasalt**

Wc **Colberg Metavolcanics of Phantom Lake Metamorphic Suite (Late Archean)**—Heterogeneous assemblage of amygdaloidal basalt, pillow basalt, tuff, lapilli tuff, paraconglomerate, and quartzite. Tuffaceous rocks range in composition from rhyolite to basaltic, but the most abundant volcanic rocks are tholeiitic basalt

q **Quartzite**—Amphibole and biotite rich; interpreted to be graywacke

p **Paraconglomerate**—The most distinctive rocks in the Colberg Metavolcanics are paraconglomerate containing granite, quartzite, and volcanic rock clasts in a coarse-grained matrix of amphibole, biotite, and quartz

Wb **Bow Quartzite of Phantom Lake Metamorphic Suite (Late Archean)**—White to pink muscovitic quartzite, feldspathic quartzite, and arkose. Muscovite-rich quartzite more common in south and feldspathic quartzite and arkose more common in north. Bow Quartzite is about 95 percent quartzite and arkose, but contains layers of conglomerate, biotite and hornblende schist, and siliceous metalimestone locally. Medium to large-scale planar crossbeds having bimodal paleocurrent directions are common and oscillation ripple marks have also been identified

Wrm **Rock Mountain Conglomerate of Phantom Lake Metamorphic Suite (Late Archean)**—Mostly muscovitic quartzite containing pebbles and granules of quartz. Interlayered paraconglomerate beds range from less than 3 ft to 1,000 ft thick. Paraconglomerate contains stretched clasts of quartz, quartzite, amphibolite, mica schist, and bright green fuchsite schist in strongly foliated quartz and muscovite (locally arkosic or garnetiferous matrix). Conglomerate is radioactive locally and contains as much as 270 ppm uranium and 95 ppm thorium

Wsc **Stud Creek Metavolcaniclastics of Phantom Lake Metamorphic Suite (Late Archean)**—Mostly mica schist, composed primarily of biotite and muscovite or both, with quartz. Plagioclase, epidote, calcite, and staurolite are in some samples. Mica schist has fragmental textures that suggest origin as tuff and graywacke. Amphibolite, which makes up approximately 30 percent of outcrops, has composition and textures that suggest it is metabasalt. Quartzite and conglomerate constitute about 20 percent of the outcrop; they consist of micaceous quartzite, fuchsitic quartzite, granule conglomerate, and quartz-rich paraconglomerate. Both types of conglomerate are radioactive and contain as much as 21 ppm uranium and 29 ppm thorium. Calcareous rocks are uncommon and range from marble to calcareous pelitic schist. Stratigraphic relationships between rocks of the Stud Creek Metavolcaniclastics is unknown

q **Quartzite**

p **Paraconglomerate**

Woc **Overland Creek Gneiss (Late Archean)**—Mostly dark-gray to purple hornblende gneiss; also contains interlayers of biotite gneiss and rare layers of amphibolite, paraconglomerate, quartzite, and garnet schist

q **Quartzite**

Wgn **Quartzo-feldspathic gneiss (Late Archean)**—Pink to gray felsic gneiss composed chiefly of plagioclase, potash feldspar, and quartz. Interlayered biotite-rich and biotite-poor gneiss common. Interlayered augen gneiss, hornblende gneiss, amphibolite, quartzite, paraconglomerate, and marble uncommon. Textures range from well-foliated gneiss that has complex interlayering of rock types to massive quartzo-feldspathic gneiss that has faint foliation. Passive isoclinal folds common in well-foliated gneiss, and mineral lineation can be recognized in most exposures

Contact

Thrust fault—Sawteeth on upper plate; dotted where concealed
Laramide age

Precambrian age—Rotated to steep dip near surface

Laramide and Precambrian age

Reverse fault—R on upthrown side; dotted where concealed
Laramide age

Precambrian age

Fault—Showing relative horizontal movement; dotted where concealed. In cross sections, A indicates movement away from viewer; T indicates movement towards viewer. If A/T symbol used, movement is Laramide and may not be in the same direction as in the Precambrian

Laramide age

Precambrian age

Laramide and Precambrian age

Fault—Ball and bar on downthrown side
Laramide age

Precambrian age

Laramide and Precambrian age

Shear zone—Precambrian age. Isolated lines away from main shear zones are localized areas of shear

Inferred former position of fault before dike intrusion—In cross section A–A′, A indicates movement away from viewer; T indicates movement towards viewer

Fold—Showing approximate trace of axial surface. Form of fold shown by following symbols

Anticline—Showing crestline and direction of and, for some anticlines, amount of plunge

Syncline—Showing trough line and direction of plunge

Tightly folded area—Showing trend and dip of bedding and direction of plunge of folds

Overturned anticline

Overturned syncline

Strike and dip of beds
Inclined

Vertical

Overturned

Strike and dip of foliation
Inclined

Vertical

Primary flow foliation in intrusive igneous rocks
Inclined

Bearing and plunge of lineations—May be combined with foliation or bedding symbols

Bearing and plunge of lineation

Lineation resulting from folded foliation

Lineation resulting from P, stretched pebble; M, mineral orientation or biotite streaks; C, crenulation. If no letter, cause of lineation uncertain

Lineation developed by intersection of surfaces

Bearing and plunge of minor anticline

Bearing and plunge of minor syncline

Sketch of folded surface showing bearing and plunge of fold axes

Bearing and plunge of lineation on overturned bedding plane

Bearing and plunge of two sets of crenulations of single foliation plane

SOURCES OF GEOLOGIC DATA FOR MAP

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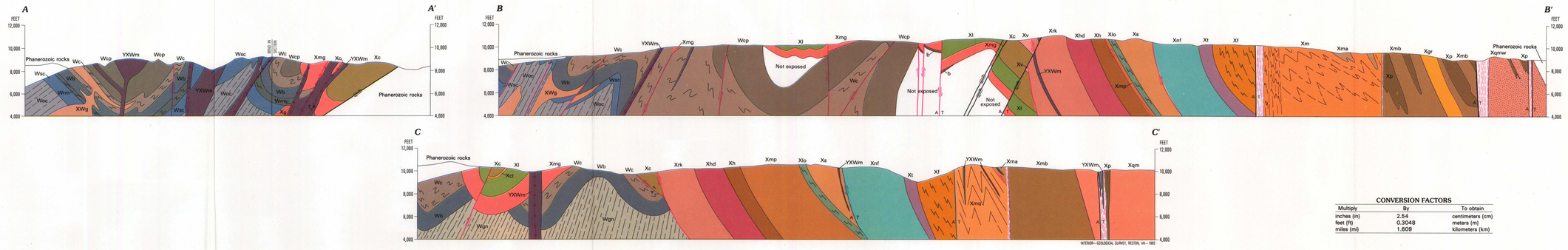

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Multiply	By	To obtain
inches (in)	2.54	centimeters (cm)
feet (ft)	0.3048	meters (m)
miles (mi)	1.609	kilometers (km)

GEOLOGIC MAP OF PRECAMBRIAN METASEDIMENTARY ROCKS OF THE MEDICINE BOW MOUNTAINS, ALBANY AND CARBON COUNTIES, WYOMING

By
R.S. Houston and K.E. Karlstrom
1992

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