

- DESCRIPTION OF MAP UNITS**
- Qal ALLUVIUM (HOLOCENE)--Chiefly silt, sand, and gravel. Shown only in the valley of the Stillwater River.
 - Qaf ALLUVIAL FAN DEPOSITS (HOLOCENE)--Sand, gravel, and boulders at the mouth of gulches on the east side of the Stillwater River valley.
 - Qt TALUS DEPOSITS (HOLOCENE)--Accumulations of angular debris derived from nearby bedrock outcrops on the steep east wall of the Stillwater valley and above Benbow mine.
 - Qc COLLUVIUM (PLEISTOCENE)--Slope-wash deposits above Chroma Lake.
 - Ql LANDSLIDE DEPOSITS (PLEISTOCENE)--Unbroken--A large block of rock which has slid with little apparent disruption, but with the formation of a pressure ridge normal to direction of flow. An unbroken landslide at the head of Nye Creek is about 1 km long, as much as 0.6 km wide, and has a difference of elevation of 270 m from head to toe. Broken--Unroofed heterogeneous mixtures of soil, glacial debris, and angular rock fragments.
 - Qg GLACIAL DEPOSITS (PLEISTOCENE)--Mostly till. Erratics of granitic rocks and gneiss 5-20 m across are fairly common. An enormous glacial deposit in the southeast part of the map area is characterized by long morainel ridges about 100-150 m high on either side of West Fishtail Creek.
 - Pz SEDIMENTARY ROCKS (PALEOZOIC)--Limestone, dolomite, and minor shale, sandstone, and edge-wise conglomerate. Lower beds, of Middle Cambrian age, are repeated six times by faulting in east part of area.
 - mi MAIFIC INTRUSIVE ROCKS (PRECAMBRIAN Y, X, OR W)--Dikes and possibly sills of basaltic composition.
 - qm QUARTZ MONZONITE (PRECAMBRIAN W)--A large stock and its apophyses that intrude the lower part of the Stillwater Complex and metamorphic rocks.
 - Wmm Banded upper zone of the STILLWATER COMPLEX (PRECAMBRIAN W)--Total thickness approximately 1,800 m (east side of the Stillwater River valley) to approximately 150 m (southeast end of mapped area). Middle mixed member--Along the Benbow mine road to, chiefly plagioclase cumulate; some post-cumulus augite is present. Plagioclase-olivine cumulate is exposed at the bottom of the unit on the ridge northwest of the road to Benbow mine. Thickness 0-13 m.
 - Wmg Middle gabbro member--Chiefly plagioclase cumulate, locally with as much as 40-50 percent post-cumulus augite and bronzite; some plagioclase-augite cumulate is present. Thickness 0-180 m.
 - Wlm Lower mixed member--Plagioclase-olivine cumulate with intercalations of plagioclase cumulate, much of which contains post-cumulus pyroxene. Thickness 0-200 m.
 - Wla Lower anorthositic member--Along the road to Benbow mine the upper part of the member is characterized by an unusual type of plagioclase cumulate that exhibits augite oikocrysts containing poikilitic olivine and plagioclase. Some plagioclase-olivine cumulate occurs near the bottom, but the member as a whole is dominantly plagioclase cumulate. Thickness 0-200 m.
 - Wlg Lower gabbro member--Along the road to Benbow mine this poorly exposed member shows, from top to bottom, a rude progression from plagioclase-augite cumulate to plagioclase-augite-bronzite cumulate to plagioclase-bronzite-augite cumulate to possible plagioclase-bronzite cumulate containing post-cumulus augite. Good exposures along the rugged ridge immediately east of the Stillwater River show, from top to bottom, (1) plagioclase cumulate that contains interstitial augite, (2) plagioclase cumulate that exhibits "inch-scale" layering expressed by sparse olivine crystals, (3) plagioclase-olivine cumulate with interlayered plagioclase cumulate, (4) plagioclase cumulate that exhibits "inch-scale" layering expressed by flattened augite oikocrysts, (5) plagioclase cumulate thinly banded with concentrations of post-cumulus pyroxene (probably chiefly augite), and (6) interbedded plagioclase cumulate and plagioclase-two-pyroxene cumulate. On the ridge west of Prairie Creek "inch-scale" layering also occurs, especially in the upper part of the member, and two-pyroxene cumulate is interlayered with plagioclase cumulate elsewhere. Total thickness 0-400 m.
 - Wn Norite member--Principally plagioclase-bronzite cumulate; however, plagioclase cumulate and interlayers are present throughout the middle and upper parts of the member. A few tens of meters above the middle of the member lies a zone of mixed rocks about 100 m thick; this consists of thin layers of plagioclase cumulate, plagioclase-olivine cumulate, pegmatoid olivine-bronzite

cumulate, and plagioclase-bronzite cumulate overlying thicker-bedded plagioclase-two-pyroxene cumulate. The pegmatoid rock and immediately overlying plagioclase cumulate are host to primary sulfides, chiefly pyrrhotite and pentlandite, which contain minerals of palladium and platinum. This zone appears to be persistent at about the same stratigraphic position throughout the exposed length of the Stillwater Complex, but it is concealed throughout the middle half of the area of the present map by downfaulted Paleozoic sedimentary rocks. Through extensive drilling and trenching by the Johns-Manville Exploration Company from 1976 to 1979, the persistence of anomalous concentrations of platinum-group metals in the zone was confirmed. Thickness 0-700 m.

ULTRAMAFIC ZONE OF THE STILLWATER COMPLEX (PRECAMBRIAN W)--Distinguished from banded upper zone by absence of cumulus plagioclase. Total thickness approximately 1,350 m. Bronzite member--Upper orthopyroxene (bronzite) cumulate. Thickness approximately 350 m.

PERIDOTITE MEMBER--Consists of cyclic units of olivine cumulate, olivine-orthopyroxene cumulate; thin chromite cumulates are present. Crosscutting dunite and harzburgite occur locally. Thickness approximately 1,000 m.

BASAL ZONE OF THE STILLWATER COMPLEX (PRECAMBRIAN W)--Basal anorthite and basal orthopyroxene cumulate with post-cumulus plagioclase. Thickness approximately 170 m.

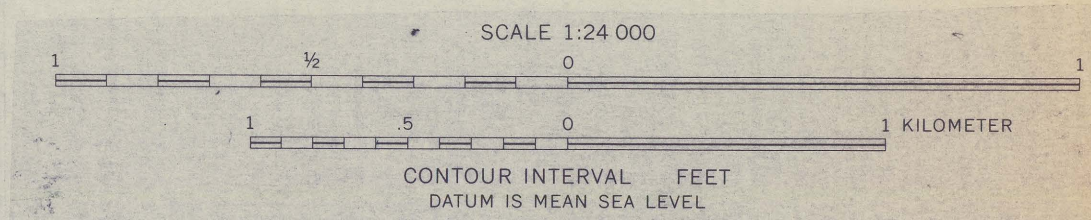
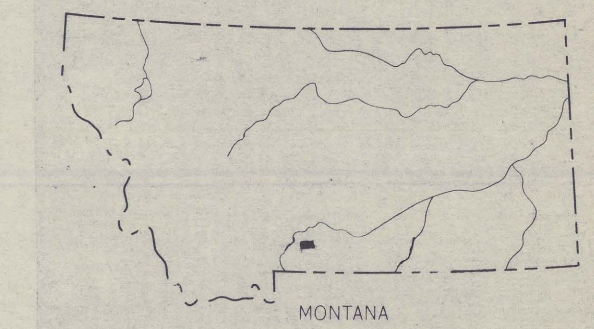
HORNFELS (PRECAMBRIAN W)--Includes metaquartzite and iron formation.

REGIONALLY METAMORPHOSED ROCKS (PRECAMBRIAN W)--Granitic gneiss, biotite schist, amphibolitic gneiss, and biotite gneiss.

UNDIVIDED GRANITIC INTRUSIVE AND GNEISS (PRECAMBRIAN W)

- CONTACT**--Dashed where concealed
- STRIKE AND DIP OF SEDIMENTARY BEDS**
- STRIKE AND DIP OF OVERTURNED BEDS**
- STRIKE OF VERTICAL SEDIMENTARY BEDS**
- LOCATION OF HORIZONTAL SEDIMENTARY BEDS**
- STRIKE AND DIP OF CUMULATE LAYERS**
- STRIKE AND DIP OF OVERTURNED CUMULATE LAYERS**
- STRIKE OF VERTICAL CUMULATE LAYERS**
- STRIKE OF FOLIATION IN IGNEOUS OR METAMORPHIC ROCKS**
- HIGH ANGLE FAULT**--Dotted where concealed; closed ball and bar on downthrown side (where known)
- THRUST FAULT**--Dotted where concealed; sawteeth on upper plate
- SACKING**--Trench caused by mountain spreading. Open ball and bar on down-dropped side
- PAVED HIGHWAY**
- GRADED ROAD**
- PRIMITIVE ROAD**
- MINE SHAFT**
- BUILDING**

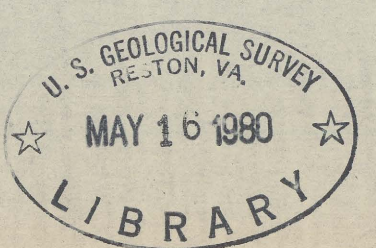
- REFERENCES**
- Carlson, Robert R., and Segerstrom, Kenneth, 1978, Preliminary geologic map of the East Boulder sector of the Stillwater Complex, Sweet Grass County, Montana: U.S. Geological Survey Open-File Report 78-704.
 - Page, Norman J., and Nockleberg, Warren J., Geologic map of the Stillwater Complex, Montana: U.S. Geological Survey Miscellaneous Investigations Series Map I-797.
 - Segerstrom, Kenneth, and Carlson, Robert R., 1977, Preliminary geologic map of upper zones of the western end of the Stillwater Complex, Park and Sweet Grass Counties, Montana: U.S. Geological Survey Open-File Report 77-370.
 - Segerstrom, Kenneth, and Carlson, Robert R., 1979, Preliminary geologic map of the Fickett Pin to Mountain View sector of the Stillwater Complex, Stillwater County, Montana: U.S. Geological Survey Open-File Report 79-656.



Base from U.S. Geological Survey, Mt. Wood, 1939, scale 1:62,500

PRELIMINARY GEOLOGIC MAP OF THE EASTERN END OF THE UPPER ZONES OF THE STILLWATER COMPLEX, STILLWATER COUNTY, MONTANA

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1980



Geology mapped in 1979 (banded upper zone) and 1969-71 (ultramafic zone and adjacent rocks); added geologic features of the ultramafic and basal zones of nearby intruding and intruded rocks generalized from Page and Nockleberg (1974)

M(200)
R290
90-304
C.1
M(28)2
S.542
C.1

