DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

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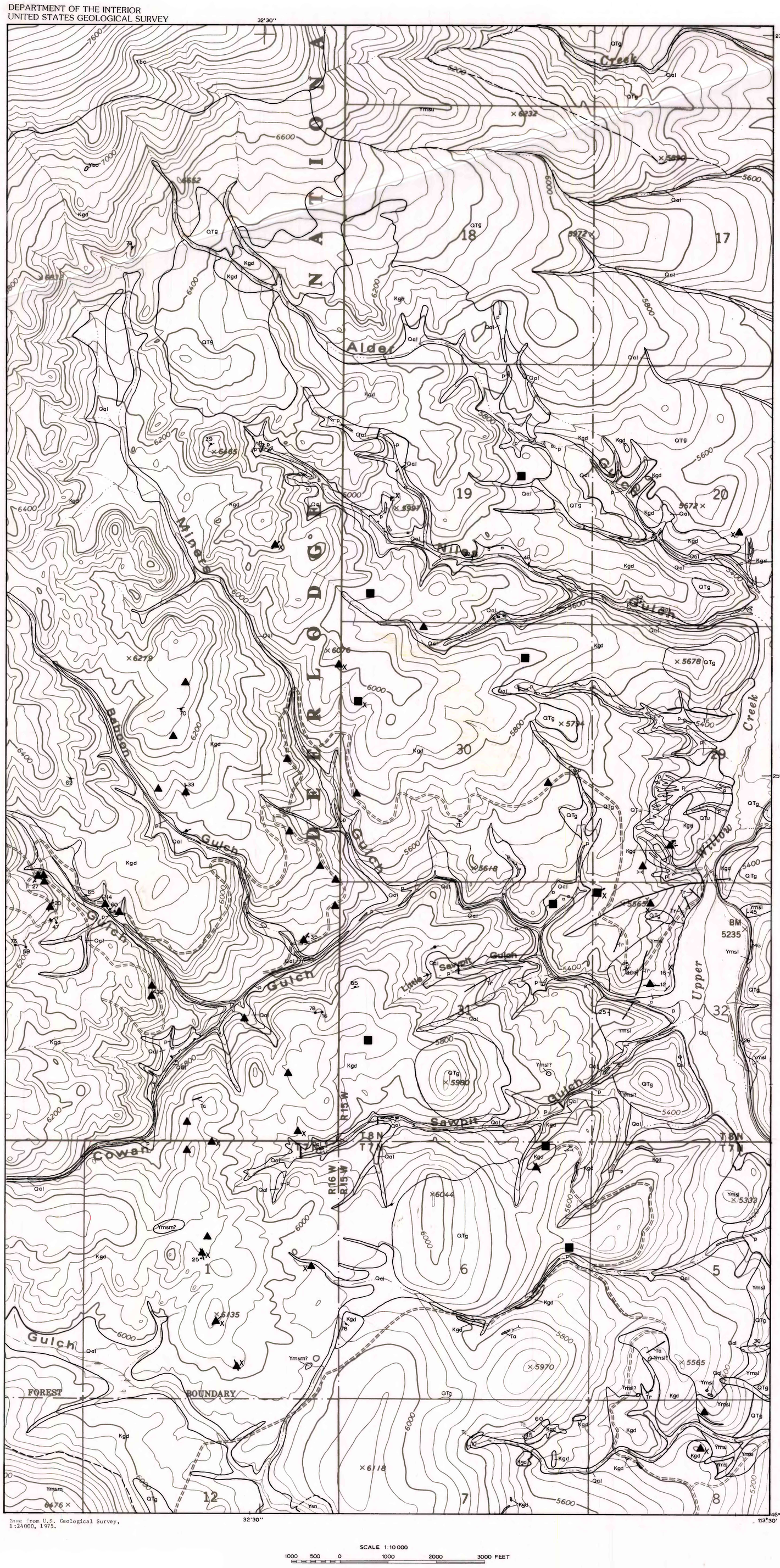

Base from U.S. Geological Survey, 1:24000, 1975.

CORRELATION OF MAP UNITS

Qal, Qs	Holocene	QUATERNARY
QTu, QTg	Pleistocene and Pliocene (?)	QUATERNARY
UNCONFORMITY		
Tb, Ta	Eocene	TERTIARY
UNCONFORMITY		
Tr, Kgd	Lower Tertiary; Upper Cretaceous	CRETACEOUS
UNCONFORMITY		
Ybo, Yms (Ymsu, Ymsm, Ymsl), Ysn	Middle Proterozoic	PROTEROZOIC

DESCRIPTION OF MAP UNITS

Qal ALLUVIUM (HOLOCENE)--Unconsolidated fluvial deposits of clay, silt sand, gravel, and boulders in stream valleys. Gray to red-brown sandy gravel interlayered with clay-rich sandy grus. Gravel consists principally of subrounded to well-rounded feldspathic quartzite recycled from Quaternary-Tertiary terrace gravels. Locally derived subangular to subrounded feldspathic quartzite, spotted hornfels, generally decomposed Cretaceous granodiorite, and quartz-limonite and barite vein material are locally abundant. Maximum thickness unknown. Placer workings (p on map) contain flour- to sand-size nuggets and wires of gold. Locally forms thin soil. Skull and bone fragments of Bison occidentalis (Early Holocene; Thomas M. Bown, personal commun., 1982) found in upper 5 ft of alluvium in Sawpit Gulch (SE ¼ sec. 31, T. 8 N., R. 15 W.)

Ql LANDSLIDE (HOLOCENE)--Landslide deposit in Quaternary-Tertiary gravel

QTg GRAVEL (PLEISTOCENE AND PLIOCENE)--Unconsolidated strath and (or) fill terrace alluvium occupying six or more levels up to 1,200 ft above present stream level. Red to yellow-brown sandy gravel and sandy clay seams up to 6 ft thick. Locally contains volcanic ash. Gravel consists of subsorted to well-sorted feldspathic quartzite and argillite, and lesser amounts of decomposed granodiorite, andesite, and highly polished quartz-limonite vein material. Generally less than 30 ft thick. Locally auriferous. Typically forms well-developed soil containing red B horizon up to 3 ft thick showing blocky ped structure. Calcic horizon in each soil shows weak carbonate coatings on bottoms of clasts. Includes colluvial and (or) alluvial fan deposits. Deposits in SW ¼ of sec. 32, T. 8 N., R. 15 W., and NW ¼ of sec. 5, T. 7 N., R. 15 W. are gray to yellow-gray, subangular to subrounded, poorly sorted Precambrian quartzite ranging from sand size to boulders 8 ft in diameter. This quartzite contains black heavy-mineral laminations up to 0.25 in. thick in tangential and planar cross beds. Maximum thickness unknown

QTu ALLUVIUM AND GRAVEL, UNDIVIDED (QUATERNARY AND TERTIARY)--Alluvium and gravel as described above. Mapped only in S ½ sec. 29, T. 8 N., R. 15 W.

Tb BASALT (EOCENE)--Flows of dark-gray basalt, locally andesitic. Weathers to dark brownish black. Weakly developed flow layering defined by elongated and alined vesicles and tabular joint blocks. Forms low irregular outcrops. Moderately porphyritic with up to 20 percent phenocrysts of hypersthene, augite, plagioclase, and altered olivine in a pilotaxitic groundmass. Commonly contains 5-20 percent fine vesicles, with yellow-brown amygdules. Overlies Cretaceous granodiorite and is covered by Quaternary-Tertiary gravels. A K-Ar age date of 50±2.0 m.y. has been reported. (Modified from Hughes, 1971 using new IUGS constants from Dalrymple, 1979.)

Ta ANDESITE (TERTIARY)--Dikes of medium- to dark-gray andesite generally 5-10 ft thick. Slightly to moderately porphyritic, with up to 15 percent phenocrysts of hornblende, plagioclase, and lesser amounts of quartz and biotite. Ranges from fresh to strong propylitic alteration. Commonly contains sericite, epidote, chlorite, and actinolite-tremolite as secondary minerals. Includes hypidiomorphic equigranular diorite dikes. Exposed in roadcuts and as resistant ribs and spines along ridge crests

▲ QUARTZ-LIMONITE AND QUARTZ-SULFIDE VEINS (TERTIARY)--Veins of milky-white quartz and generally massive limonite 4 in. to 3 ft thick. Exposed in roadcuts, prospects pits, trenches, and as residual vein fragments. Characteristically displays intricate limonite boxwork, containing striated cubic casts and fibrous limonite network. Quartz is generally coarse grained, subhedral to euhedral, commonly vuggy, and limonite stained. Rarely exhibits cockscomb structure. Quartz also present as tiny veinlets and opaline coatings in limonite. Locally contains minor and variable amounts of barite, botryoidal manganese and iron-oxide minerals, pyrite, and rare, fine-grained, equant gold

■ BARITE-QUARTZ-LIMONITE VEINS (TERTIARY)--Veins of coarse white crystalline barite, exposed in prospect pits and occurs as residual vein fragments. Veins generally 4 in. to 6 ft thick, locally up to 20 ft thick. Barite content averages 10-40 percent and, in places, is up to 90 percent. Limonite ranges from 10 to 80 percent. Commonly exhibits well-developed limonite boxwork with cubic casts 0.25-0.5 in. long. Manganese oxide minerals, quartz, and opaline silica are common. Pyrite, chalcopyrite, tetrahedrite, and very fine grained, wire gold identified in some veins

Tr RHYOLITE (TERTIARY)--Dikes of light- to medium-gray rhyolite, dacite, and rare monzogranite, 10-20 ft thick and moderately to strongly altered to sericite. Rhyolite and dacite are porphyritic and contain 20-65 percent phenocrysts of generally altered plagioclase and biotite with resorbed quartz. Groundmass generally quartz and potassium feldspar. Monzogranite is allotriomorphic, fine grained, and only very slightly porphyritic. Exposed in roadcuts and as resistant ribs and spines along ridge crests

Kgd GRANODIORITE (UPPER CRETACEOUS)--Stock of medium- to light-gray, hypidiomorphic, medium-grained hornblende-biotite granodiorite. Strongly jointed and spheroidally weathered. Forms pinnacles and tors up to 120 ft tall. Weathers readily to grus. Composition ranges from quartz monzodiorite, to granodiorite, to monzogranite. Quartz content ranges 15-30 percent. Biotite and lesser amounts of hornblende compose 5-30 percent of the rock. Generally equigranular, but locally porphyritic with medium to coarse phenocrysts of plagioclase and coarse glomerocrysts of biotite and hornblende. Local alteration, defined by chalky feldspars and the absence of mafic minerals accompanied by closely spaced quartz-limonite, quartz-sulfide, and/or barite-quartz-limonite veins. Outcrops poor to fair, commonly covered by gravel and a thick soil layer. Intrudes Proterozoic sediments to the north, west, and east; overlain by Tertiary volcanics to the south

Ybo BONNER FORMATION (MIDDLE PROTEROZOIC)--Pale-pink, buff and purple, medium to very coarse grained, rounded to well-rounded feldspathic quartzite. Pink and purple, 0.25-in.-thick planar cross laminations common. Contains some conglomeratic beds with very well rounded, pink to white quartz pebbles in a sand-sized feldspathic matrix. Feldspars typically white and chalky. Only exposed as felsenmeer along Sandstone Ridge

MOUNT SHIELDS FORMATION (MIDDLE PROTEROZOIC)--Only parts of the lower, middle, and upper members are present in the map area. Thermally metamorphosed near Cretaceous granodiorite

Ymsu Upper Member--Fine-grained sandstone and interbedded red argillite. Very poorly exposed. Identification based on small chips only

Ymsm Middle Member--Tan, reddish-pink and gray-black, fine- to medium-grained, well-indurated feldspathic quartzite. Quartzite is well sorted and grains are subangular to subrounded. Thinly to thickly bedded, planar crossbeds. Generally occurs as xenoliths ranging from 30 to 300 ft in diameter, except in the southwest portion of the map area

Ymsl Lower Member--White, tan, or dark-grayish-black, fine- to medium-grained quartzite interbedded with thinly laminated argillite. Quartzite contains no detrital clay, is well sorted, and grains are very well rounded. Argillite is generally black, occurs as thin beds 0.5-1.0 in. thick, and is interbedded with quartzite beds up to 4 in. thick. Quartzite beds commonly contain tangential and angular cross beds and ripple marks. Argillite beds form spotted hornfels where metamorphosed. Outcrops in contact with Cretaceous granodiorite commonly contain apophyses along bedding planes

Ysn SNOWSLIP FORMATION (MIDDLE PROTEROZOIC)--Interbedded red and green argillite, reddish argillaceous siltite, and subordinate, tan, fine-grained quartzite. Mud cracks, ripple marks, and cross beds common. Locally may contain salt crystal casts and water expulsion structures. Forms poor outcrops of small platy rubble

Map Symbols

- CONTACT--Dashed where approximately located
- DIKES--Dashed where approximately located; dotted where concealed

STRIKE AND DIP OF BEDS
- 25 — Inclined

STRIKE AND DIP OF VEINS
- 35 — Inclined
- Vertical
- Strike only

STRIKE AND DIP OF JOINTS
- 85 — Inclined
- Vertical
- 59/76 — Joint system--Flags indicate direction of dip, poles indicate strike, intersection of poles locate point of measurement

STRIKE AND DIP OF FOLIATION--Includes flow layering
- 10 — Inclined

- VERTICAL SHAFT
- ADIT OR TUNNEL
- PROSPECT

EXPLORATION TRENCH
- Open
- Backfilled

- ABANDONED CABIN
- DAM
- (P) — PLACERED GROUND--Includes sluiced stream channels, sluiced terrace deposits, and tailings

REFERENCES

Dalrymple, B. G., 1979, Critical tables for conversion of K-Ar ages from old to new constants: Geology, v. 7, p. 558-560.

Hughes, G. J., Jr., 1971, Petrology and tectonic setting of igneous rocks in the Henderson-Willow Creek igneous belt, Granite County, Montana: Houghton, Michigan Technological University, Ph. D. thesis, 236 p.

Index map of study area showing credit for geologic mapping. 1, J.S. Loen and M.J. Blaskowski, 1982. 2, Unpublished reconnaissance mapping by C.A. Wallace, 1978.

U.S. Geological Survey
OPEN FILE REPORT
This map is preliminary and has not been reviewed for conformity with U. S. Geological Survey editorial standards or stratigraphic nomenclature.

MAP SHOWING GEOLOGY AND MINERAL DEPOSITS OF THE SOUTHEAST PART OF THE ALDER GULCH QUADRANGLE, GRANITE COUNTY, MONTANA

By

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1983