GEOLOGIC MAP OF PARTS OF THE ARLEE, SAINT IGNATIUS, GOLD CREEK, AND ST. MARYS LAKE 7.5' QUADRANGLES NORTHWEST MONTANA

Michael H. Hofmann and Marc S. Hendrix

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Introduction

This project focused on mapping the distribution of Pleistocene and Holocene sediments along the southeastern Mission Valley and eastern Jocko Valley in western Montana (USGS Arlee, Saint Ignatius, Gold Creek, St. Marys Lake 7.5' quadrangles). Holocene and Pleistocene sediments are most common in the northwestern part and in the far eastern part of the map area, whereas Precambrian rocks of the Belt Supergroup are widespread. Pleistocene deposits in the map area are dominated by till and glacial outwash related to advances of smaller alpine glaciers flowing down valleys of the Mission Range. Pleistocene sediments also include patches of sub-lacustrine sediments related to glacial Lake Missoula. Holocene sediments in the map area consist of a complex suite of alluvial, fluvial, and colluvial sediments.

Early studies of Pleistocene deposits from the Mission Valley describe evidence for one major advance of the Flathead lobe of the Cordilleran ice sheet to the southern part of the Mission Valley south of Saint Ignatius (Elrod, 1903; Davis, 1920; Nobles, 1952; Alden, 1953; Richmond and others, 1965; Richmond, 1986; Ostenaa and others, 1990). In contrast, Ostenaa and others (1995), and Levish (1997) interpreted most of the diamictite in the Mission Valley south of the Polson Moraine, a terminal moraine 45 km north of the map area, as sub-lacustrine deposits related to glacial Lake Missoula. The results of our mapping suggest that the glacial tills and outwash sediments are directly related to the small alpine glaciers, but no evidence was found for a major advance of a Flathead lobe as far south as Saint Ignatius, Montana.

The southern boundary of the map area (Gold Creek, Arlee quadrangles) is located along the Jocko River and the main gravel road between Arlee and Cedar Campground, respectively. The western and northern boundaries of the map area on the Arlee and Saint Ignatius quadrangles (figure 1) follow township and range boundaries, whereas the north and northeastern boundary of the map area (St. Marys Lake quadrangle) is located approximately at the base of the steep Mission Range slopes (figure 1).

Structure

The Mission Fault is the dominant geologic structure in the northern part of the map area and consists of a single synthetic down-to-west normal fault that drops the Mission Valley relative to the Mission Range. At the east end of the Mission Reservoir, Ostenaa and others (1990, 1995) conducted trenching studies of the fault in which they documented a major seismic event at about 7,700 Cal. Yr. BP* and an older event with poorly constrained chronology (~15,000 Cal. Yr. BP). In the map area, the Mission Fault intersects with the Lewis and Clark line, a sinistral-transpressive shear zone in western Montana (e.g., Wallace and others, 1990; Sears and Clements, 2000). No striking

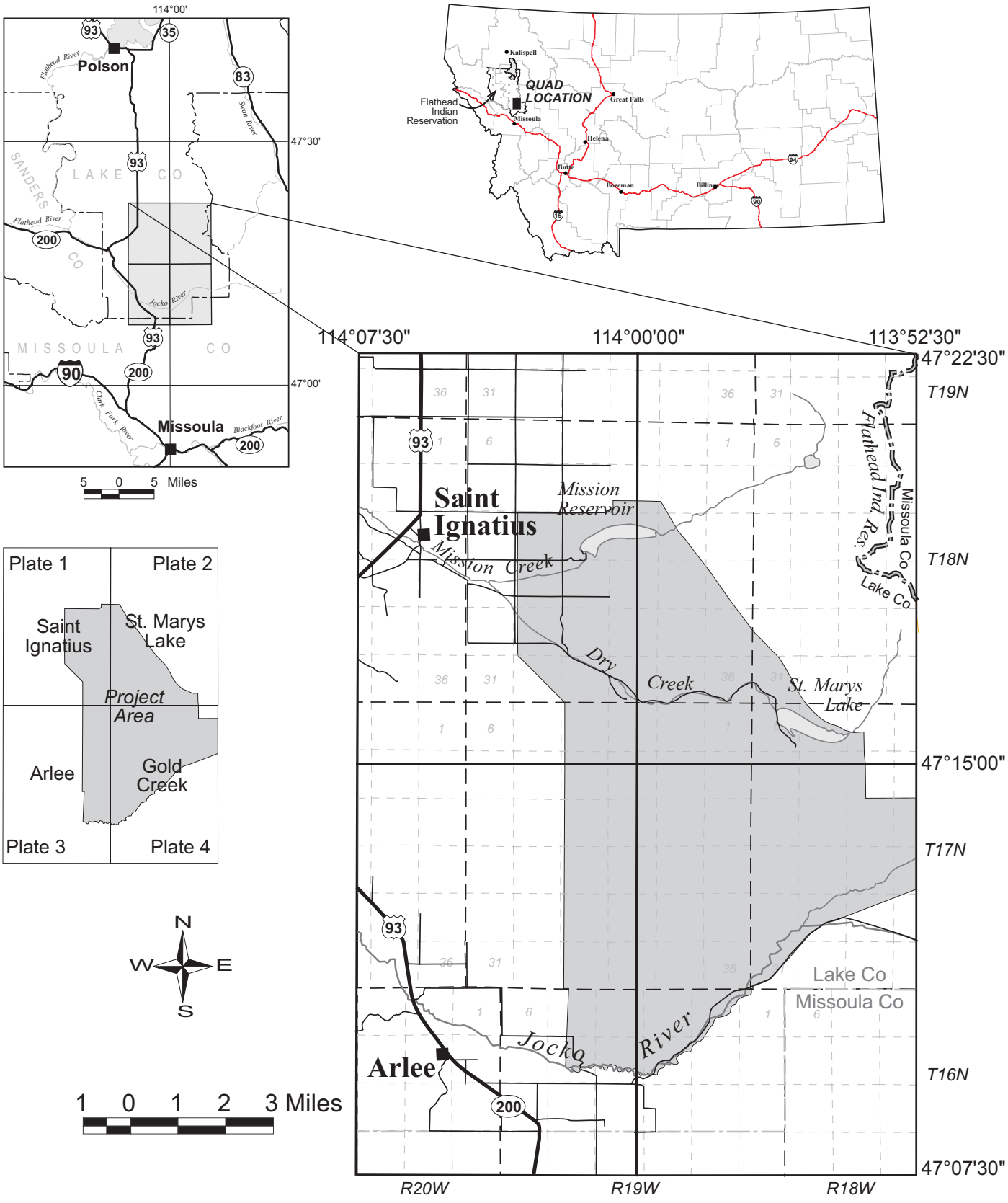


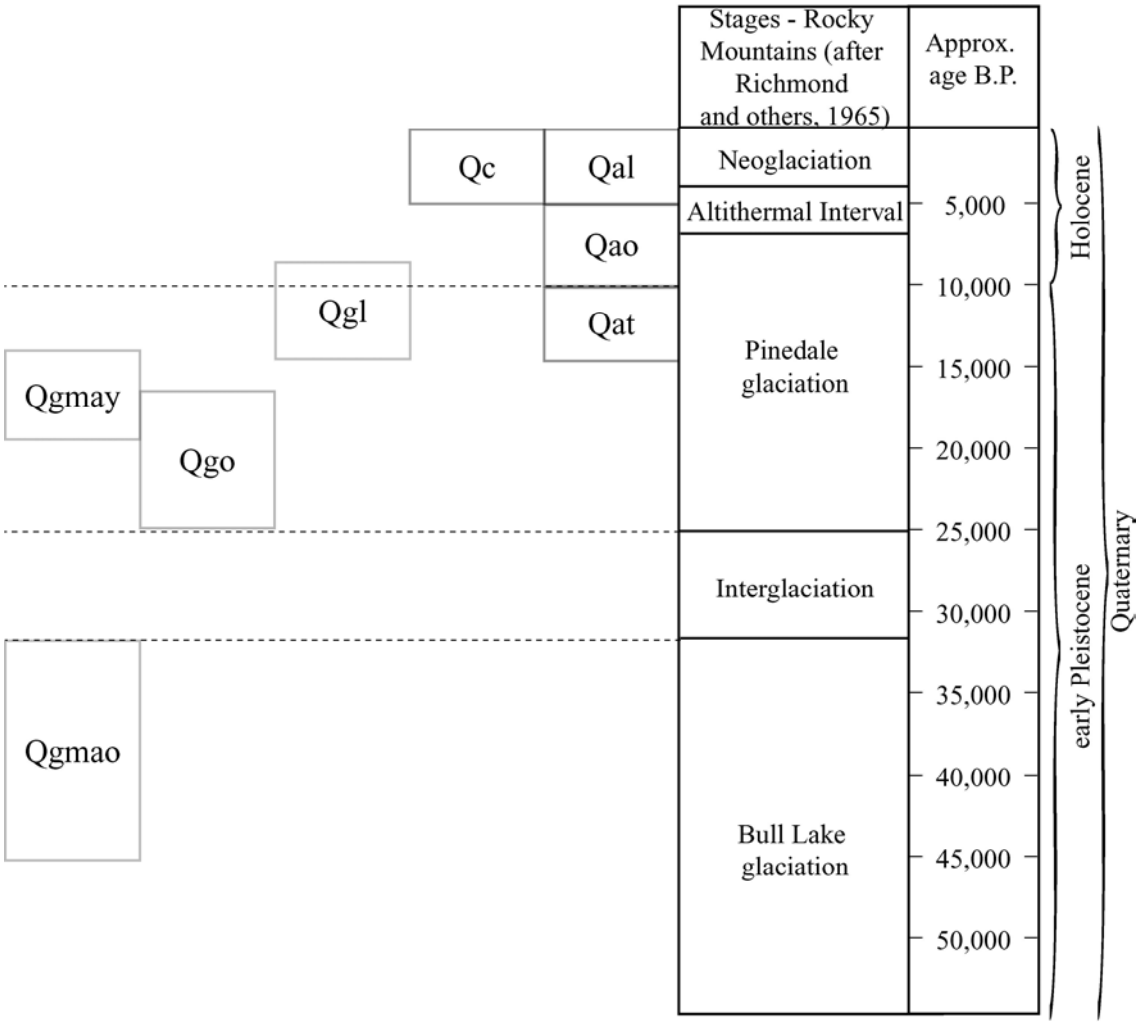
Figure 1. Locations of the Arlee, Saint Ignatius, Gold Creek, and St. Marys Lake7.5' quadrangles and the area mapped for this report.

evidence has been found for Pleistocene or Holocene movements along faults related to the Lewis and Clark tectonic lineament. Evidence of pre-Pleistocene fault offsets is present in the form of offset Precambrian Belt Supergroup rocks, locally overlain by undeformed Pleistocene sediment.

* Dates given as calendar years before present (Cal Yr. BP) are calibrated dates. Calibrated results are usually older than conventional radiocarbon ages.

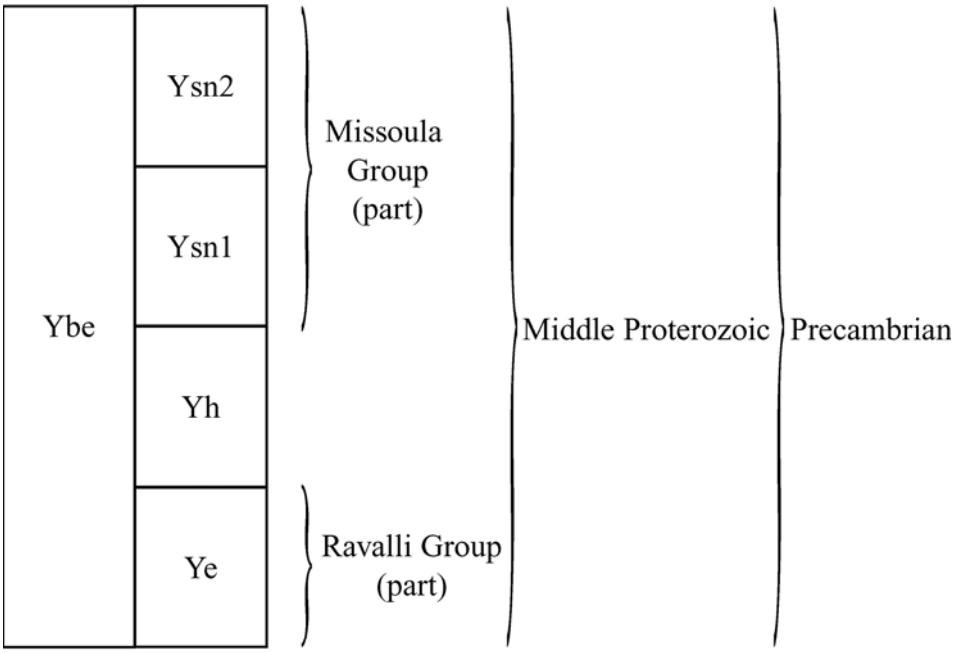
CORRELATION OF QUATERNARY MAP UNITS

ARLEE, SAINT IGNATIUS, GOLD CREEK, AND ST. MARYS LAKE 7.5' QUADRANGLES



CORRELATION OF PRECAMBRIAN MAP UNITS

ARLEE, SAINT IGNATIUS, GOLD CREEK, AND ST. MARYS LAKE 7.5' QUADRANGLES



DESCRIPTION OF MAP UNITS

ARLEE, SAINT IGNATIUS, GOLD CREEK, AND ST MARYS LAKE 7.5' QUADRANGLES

Qal **Alluvium of modern streams (late Holocene to present)** – Stream alluvium within active channels and flood plains. Includes reworked older coarse-grained deposits within active channels, fine-grained overbank sediments, and fine-grained, organic-rich possible swamp sediments within Pistol Creek. Contains localized colluvium from oversteepened banks and creek walls.

Qc **Colluvium (Holocene to present)** – Poorly to moderately sorted slopewash colluvium. Includes localized slumps and rockfall deposits. Angular to sub-angular clasts, poorly sorted.

Qao **Alluvium, older (early Holocene)** – Stream alluvium covering terraces ~2 m above present stream channel. Includes older, reworked, coarse-grained deposits within an older (early Holocene) channel. Sediments are very similar to Qal. In some areas Qao is mixed with fine-grained overbank sediments of the active river channel.

Qgl **Glacial lake deposits, undivided (late Pleistocene and Holocene)** – Well-sorted fine sand and silt. Sediments are present near the mouth of Dry Creek. Equivalent sediments also underlay thin gravel beds near Cold Creek.

Qat **Alluvial terrace deposits (Pleistocene)** – Alluvial deposits that cover terraces ~4 m above present stream channel. Includes older, coarse-grained deposits within an older (late Pleistocene) channel. The contact between Qat and Qgo is commonly another terrace. Sediments are very similar to Qal.

Qgmay **Youngest alpine moraine (late Pleistocene)** – Unconsolidated, poorly sorted, sandy and silty cobbles and gravel, angular to sub-angular deposits related to the range front of the Mission Mountains at Mission Reservoir. Forms high, prominent, sharp-crested lateral moraines and less well developed terminal moraines.

Qgo **Glacial outwash sediments, undivided (Pleistocene)** – Clast-supported, silty and sandy cobble gravel. Forms the broad, gently sloping plain in the northwestern part of the map area and most of the sediments along the Dry Creek Valley and Jocko Valley. Contains well-rounded cobbles of rocks of the Belt Supergroup and Precambrian igneous rocks. Sediments in the narrow creeks and close to the mouths of the creeks are coarser (boulder size) but still well-rounded. A gently south-west dipping, alluvial fan-like structure, south of Twin Lakes, is also formed by these sediments.

Qgmao **Oldest alpine moraine (Pleistocene)** – Characterized by matrix-supported, sandy and silty cobble and boulder gravel of local Belt rocks. Deposits form moderately high lateral moraines near St. Marys Lake; crests not very pronounced.

Considered to be late Pleistocene in age (Bull Lake glaciation equivalent, >35,000 cal. y.b.p.).

Ybe **Belt Supergroup rocks, undivided (Middle Proterozoic)** – Metasedimentary rocks of the Belt Supergroup. Rocks include red and green argillite, fine-grained quartzite, carbonaceous argillite and siltite of the middle Proterozoic Saint Regis, Empire, and Helena Formations, and Missoula Group.

Ysn2 **Snowslip Formation of the Belt Supergroup, member 2, informal** – Predominantly green argillite and coarser sand beds cemented by carbonate. The coarser beds, lighter in color, are more common near the base. Desiccation cracks, ripples, and mud-chips are common.

Ysn1 **Snowslip Formation of the Belt Supergroup, member 1, informal** – Reddish argillite and siltite interbedded with few beds of coarse sand. Abundant mud-chips, desiccation cracks, and fluid escape structures. Greenish beds occur locally. Coarser sand beds are cemented by calcite and dolomite.

Yh **Helena Formation of the Belt Supergroup** – Mostly gray to greenish-gray limestone locally containing stromatolites interbedded with dolomite, dolomitic siltite, siltite, and argillite. Characteristic are beds with intraclasts containing molar-tooth structures.

Ye **Empire Formation of the Belt Supergroup** – Grayish-green argillite and locally slightly dolomitic siltite. Medium-grained, light to white quartz arenite layers occur. Characteristic are mudcracks within the green argillite, ripple marks, and subhorizontal calcite filled voids. Pyrite is common.

MAP SYMBOLS

Contact – dashed where inferred, dotted where concealed; most contacts within the Quaternary map units are approximate.

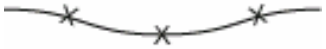
Faults – dashed where inferred, dotted where concealed; sense of movement uncertain.

Normal faults – dashed where inferred, dotted where concealed; bar and ball on downthrown side. The positions of the faults are based on changes of bedrock lithology, changes in strike and dip, and offset of bedrock and surficial Quaternary sediments.

Syncline - dashed where inferred, dotted where concealed; arrows mark direction of plunge.

Anticline - dashed where inferred, dotted where concealed; arrows point in direction of plunge.

River terraces - terraces of an older river channel along modern Dry Creek that existed during the early Holocene or late Pleistocene.



Moraine crest – several moraine crests exist within the map area. Very pronounced, sharp crests are related to younger moraines, probably of Pinedale age; more rounded, less pronounced crests are inferred to be Bull Lake equivalent moraines.

Strike/dip – strike and dip direction and angle of dip of middle Proterozoic Belt rocks.

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