

4. GEOLOGY

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Precambrian History

The Medicine Bow Mountains have a core of Precambrian rocks. They contain the boundary, the Cheyenne Belt, between the Wyoming Province to the NW and the accreted Proterozoic continental crust to the SE (Karlstrom and Houston 1984). The Wyoming Province consists of Archean rocks that are locally intruded and (or) overlain by rocks of Proterozoic age, including the lithologies present in the West Glacier Lake drainage basin.

The Precambrian tectonic history of the Medicine Bow Mountains is described in detail by Karlstrom and Houston (1984). The Medicine Peak Quartzite found in the West Glacier Lake drainage basin was deposited as part of the Snowy Pass Supergroup between 2000 and 2300 million years (My) ago in a widening rift-formed, passive-margin basin. The widening of the basin included faulting in the underlying Archean rocks. Faults gave access to mafic dikes, which intruded as high as the Lower Libby Creek Group, including the Medicine Peak Quartzite. These dikes make up an estimated 15% to 20% of the bedrock in the Glacier Lakes and Lost Lake drainage basins.

Regional metamorphism in the Medicine Bow Mountains took place between 1650 and 1700 My ago during the main collision of the Wyoming Province with island arcs to the SE. The mineralogy of the mafic dikes indicates that this metamorphism was greenschist facies (Karlstrom and Houston 1984).

Petrology of Rock Units in the Study Area

The bedrock in the study area is the Medicine Peak Quartzite that is intruded by mafic dikes. The Medicine Peak Quartzite is a 1700-m-thick complex of braided fluvial deposits interfingering with tide-dominated delta plain sediments (Flurkey 1983). Lenses of schist in the quartzite were probably local clay deposits within the unit. Mineralogically the bulk rock, not including the schist lenses, can be described as follows:

- 1) 60–100% quartz
- 2) phyllosilicates up to 38%: sericite (potassium end-member), local chromium-bearing sericite (fuchsite), kaolinite, and pyrophyllite
- 3) up to 25% kyanite
- 4) 3% feldspar: mainly albite plagioclase with an average anorthite content of 7%; potassium feldspar does not exceed 30% of feldspar
- 5) opaque minerals up to 8% occur in colors of red, steel gray, white, and yellow

- 6) accessory heavy minerals, including zircon, tourmaline, and, rarely, apatite (Flurkey 1983)

Thin sections of quartzite collected in the study area agree with Flurkey's descriptions. Color banding in rocks of the study area results from layers containing kyanite, sometimes with phyllosilicates, and occasionally opaque minerals.

Weight percentages for major oxides in mafic rocks were calculated based on mineralogic point count data and agreed reasonably well with those from bulk rock analyses. Mafic rocks consist of approximately:

- 1) 44% actinolite;
- 2) 30% epidote;
- 3) 7–15% albite;
- 4) up to 7% quartz;
- 5) up to 5% chlorite;
- 6) up to 4% sphene;
- 7) up to 2% biotite;
- 8) less than 0.5% opaques, including chromite and (or) magnetite and pyrite.

Karlstrom and Houston (1984) describe these dikes as gabbroic, although they are referred to as metadiabase by Oviatt (1977). In this report, the dikes are generally referred to as mafic dikes. Bulk chemical analyses for both the mafic rocks and quartzite, as well as mineral compositions measured by electron microprobe, are given in Rochette (1987).

Cenozoic History

During the Paleocene, Laramide deformation defined the Medicine Bow Mountains and uplift kept pace with erosion, which stripped Phanerozoic sediments where Precambrian rocks are now exposed (Blackstone 1975, Houston et al. 1978). Quaternary and Holocene glaciation sculpted the Snowy Range to its present geomorphology and left till of local bedrock in the Glacier Lakes area; soil development began as glaciation ended.

It appears that the study area was included in the collection area of the Libby Glacier, by comparison with work by Atwood (1937) and Mears (1953). The Libby Glacier collected in an area east of Browns Peak and to the north along the east of the range, and flowed to the east along Libby Creek.

It is assumed that present soils in the drainage basin are in equilibrium with the present climate. Work by Sansom (1972) on Pinedale moraines of the Libby Creek area supports this assumption. Sansom found no clear trends in soil properties to relate moraine age to soil maturity and concluded that present soils are in equi-

librium with the present climate. He suggested that the severity and short duration of climates was the reason that expression of historic climates in the soils is not seen.

Presently in the Snowy Range there are no glaciers. However, there are permanent snowfields, such as the one that feeds West Glacier Lake. Mears (1953) reported a contemporary orographic snowline of 11,000 ft (3353 m). This value is consistent with the snowfields in the West Glacier Lake drainage basin.

In summary (based on work by Oviatt 1977, Benedict 1973, Breckenridge 1969, McCallum 1962), tills in the Glacier Lakes area are probably late Pinedale in age, so soil formation probably began in the West Glacier drainage basin around 10,000 before present (B.P.). The Altithermal probably did not significantly affect regions as high in the range as the study area, so no concentrated calcium carbonate horizons are expected in the soils. Soils formation may have been interrupted to some extent around 1900 B.P., when protalus ramparts formed (protalus ramparts suggest the presence of ancient snowfields, Flint 1971). Finally, soils genetically related to the local bedrock in the watershed should be forming in the present climate. Chemical weathering in the West Glacier Lake drainage has been described in detail elsewhere (Rochette 1987, Rochette et al. 1988). A map describing the general geology of GLEES is provided in figure 4.1.

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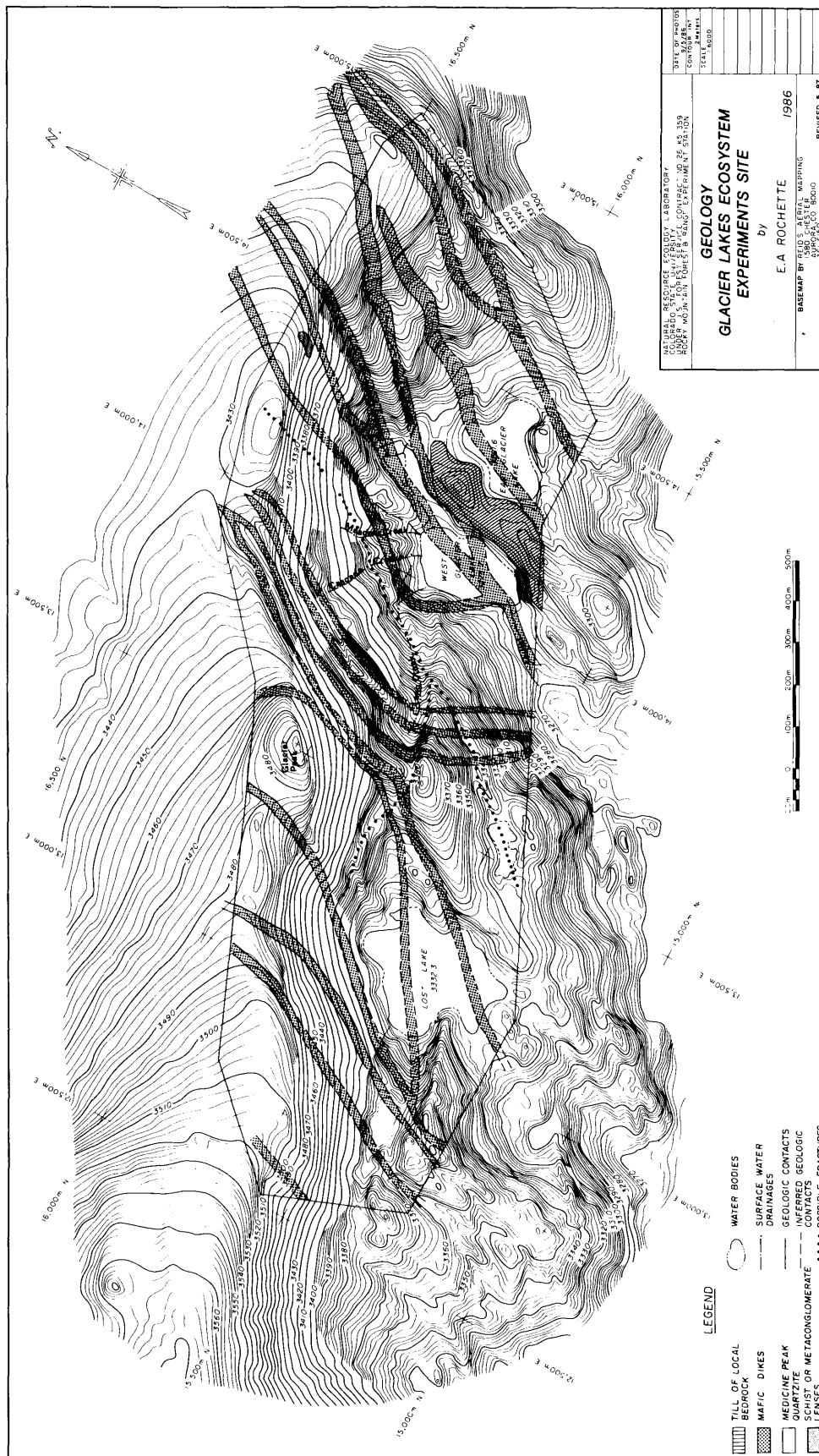


Figure 4.1.—Geological map of the GLEES.