

Quaternary geology of Reef Creek and the Painter Gulch area, Park County, Wyoming

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INTRODUCTION

Reef Creek flows northeast from Windy Mountain and then north into Clarks Fork of the Yellowstone River. The East Fork of Painter Gulch originates southeast of Reef Creek and flows south to join the Middle Fork and West Forks of Painter Gulch. These tributaries drain into Sunlight Creek to the south. A low divide (2530 m) is located south of the large bend in Reef Creek and north of the headwaters of the East Fork of Painter Gulch (Figure 1).

Pilgrim Limestone, Madison Limestone, and Absaroka Volcanic bedrock crop out in the Reef Creek and Painter Gulch area (Pierce and Nelson, 1971). Granitic bedrock is found only in the northernmost section of Reef Creek (below 2000 m) near the confluence of Reef Creek and Clarks Fork; all other granitic and gneissic rocks found in Reef Creek and Painter Gulch valleys are glacial erratics which have been transported from the Beartooth Plateau to the north (Parsons, 1939).

The Clarks Fork region was glaciated during the Pinedale glaciation of the Pleistocene (25,000-8,500 years ago). Parsons (1939) believed the Clarks Fork outlet glacier of the Yellowstone ice sheet flowed southeast entering several tributaries of Clarks Fork of the Yellowstone River, including Reef Creek and the lower portion of Sunlight Basin. Parsons (1939) concluded that the Clarks Fork outlet glacier blocked the drainage of Sunlight Basin and formed a glacial lake (Glacial Lake Sunlight) that extended up valley into the Painter Gulch area. Supporting Parsons conclusions, Erb (1995) determined a maximum lake level at 2210 m. The main objective of our investigation was to provide a better understanding of the glacial history of the Reef Creek and Painter Gulch drainages.

METHODS

The environment of the Reef Creek and Painter Gulch area had both positive and negative effects on our field work. The heavy vegetation in Reef Creek and Painter Gulch often caused difficulties in observing erratics and various landforms. In addition, steep valley sides increase mass wasting processes which shift erratics down-slope and thus provide false ice limit elevations. However, the Yellowstone fires of 1988 helped our investigation. Burned trees increased landform visibility on the west slopes of East and Middle Forks, the south slope of Cathedral Cliffs, and the Reef Creek floodplain. Ice limits were determined by the highest erratics located along the valley sides. The elevation of the highest granitic erratics beyond the front of terminal moraines were deemed ice-rafted erratics and therefore used to determine the maximum level of Glacial Lake Sunlight.

SEDIMENTS

Within the Reef Creek and Painter Gulch Valleys there are four distinct deposits that can be divided into glacial and non-glacial origin. The glacial deposits consist of till and outwash. Till is poorly sorted, generally unstratified debris consisting of granitic, limestone, and volcanic rocks in a fine-grained matrix. Outwash is usually stratified and composed dominantly of cobbles and pebbles of limestone with only clasts of granitic, sandstone, and volcanic rock fragments.

Alluvium and colluvium are non-glacial deposits found on the valley floors and sides of Reef Creek and Painter Gulch. Alluvium includes poorly sorted, rounded pebbles and cobbles of limestone, granitic, and volcanic rock. Colluvium contains the same lithologies, but the pebbles and cobbles are subangular rather than rounded.

GEOMORPHIC FEATURES

The geomorphic features in Reef Creek and the Painter Gulch area can be subdivided into glacial and postglacial features. Glacial features include glacial pavement, roche moutonnees, lateral and terminal moraines, a meltwater channel, and possible or probable kame terraces. Postglacial features include outwash terraces, alluvial fans, flood plains, and postglacial gorges.

The glacial pavement is located on strata of the Pilgrim and Meagher Limestone along the north side of Cathedral Cliffs and Russell Peak. Six distinct roche moutonnees were eroded in Precambrian granite near the confluence of Reef Creek and Clarks Fork of the Yellowstone river. Lateral and terminal moraines are located along both Reef Creek and the East Fork of Painter Gulch. A short meltwater channel lies on the divide between Reef Creek and East Fork. The possible kame terraces are found along the valley sides of East Fork. Two postglacial gorges were cut in lodgment till are located along Reef Creek, one east of the terminal moraine and the other downvalley where Reef Creek turns north.

QUATERNARY HISTORY

During the Pinedale Glaciation (25,000-8,500 years ago), ice from the Clarks Fork outlet glacier of the Yellowstone ice sheet flowed east along Cathedral Cliffs scouring the bedrock and forming roche moutonnees and glacial pavement near the mouth of Reef Creek (Figure 1). The roche moutonnees form hilly topography north of Highway 296. The two benches of glacial pavement are found approximately 1 km south of the intersection of Reef Creek and Highway 296; the lower bench (2158 m) is positioned on the Meagher Limestone, and the upper (2268 m) is located on the Pilgrim Limestone. Both benches have boulder size granitic erratics scattered across the pavement. As the outlet glacier progressed eastward, part of the ice crossed over most of Cathedral Cliffs at a maximum elevation of 2730 m, and then split into three lobes as it moved southward along Reef Creek. These lobes include the west lobe, the east lobe, and the south lobe.

The west lobe extended toward the headwaters of Reef Creek, deposited granitic erratics throughout the valley, and built a terminal moraine consisting mainly of volcanic and limestone sediments from the Cathedral Cliffs area. This moraine dammed the Reef Creek drainage creating a small glacial lake between Windy Mountain and Cathedral Cliffs. Several ice rafted granitic erratics were found up-valley from the terminal moraine, at an elevation of 2621 m, marking the lake limit. The east lobe crossed the divide southwest of Russell Peak and stretched 0.5 km into the Russell Creek drainage. The south lobe crossed the divide (2548 m) into the valley of the East Fork of Painter Gulch. Ice which flowed south along East Fork formed numerous lateral moraines throughout the valley and a terminal moraine approximately 3 km south of the divide. The terminal moraine is primarily composed of limestone and granite with small traces of volcanic rock. The granitic erratics we discovered, between Cathedral Cliffs and the terminal moraine in East Fork indicate the ice gradually decreased in elevation from 2730 m to 2182 m. A section of ice at the headwaters of East Fork crossed a divide (2410 m) and flowed southwesterly to occupy a portion of the Middle Fork valley. Several abnormally large granitic erratics found within the Middle Fork valley mark the movement of ice through this area.

As the ice ablated and decreased in volume, the south lobe separated from the Clarks Fork outlet glacier and stagnated. Kame terraces formed along the valley sides of East Fork. Meltwater from the Clarks Fork outlet glacier carved a narrow channel in the divide (2548 m) as it drained into the East Fork valley. Outwash plains were deposited at the mouths of the East and Middle Fork drainages of Painter Gulch.

Ice from the Clarks Fork outlet glacier also extended into Sunlight Basin and dammed Sunlight Creek (Parsons 1939). Glacial Lake Sunlight rose to a maximum elevation of 2200 m and deposited ice-rafted granitic erratics throughout the lower portion of Painter Gulch. Erb (1995) suggests the lack of shoreline features is the result of fluctuating lake levels, possible catastrophic drainages, and occasional refilling of the lake. When Glacial Lake Sunlight emptied, the East, Middle, and West Forks of Painter Gulch cut through the outwash and alluvium to form terraces.

In the Holocene, mass wasting, fluvial erosion, and fluvial deposition modified and reshaped the glacial landscape. Reef Creek cut through lodgment till to create two local postglacial gorges. Floodplains developed along portions of Reef Creek and the Painter Gulch area. Alluvial fans developed along the edges of the floodplains. The 1988 Yellowstone fires accelerated mass wasting and fluvial processes in some of these drainages.

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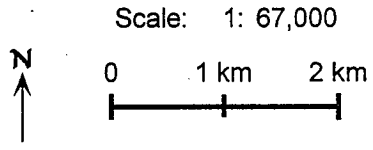
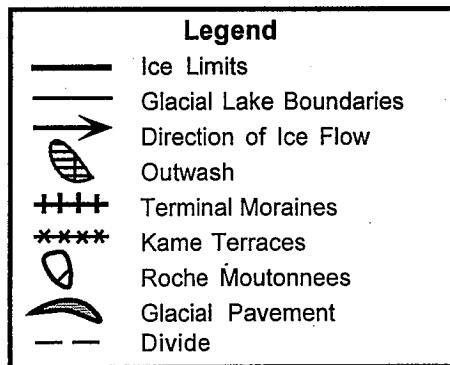
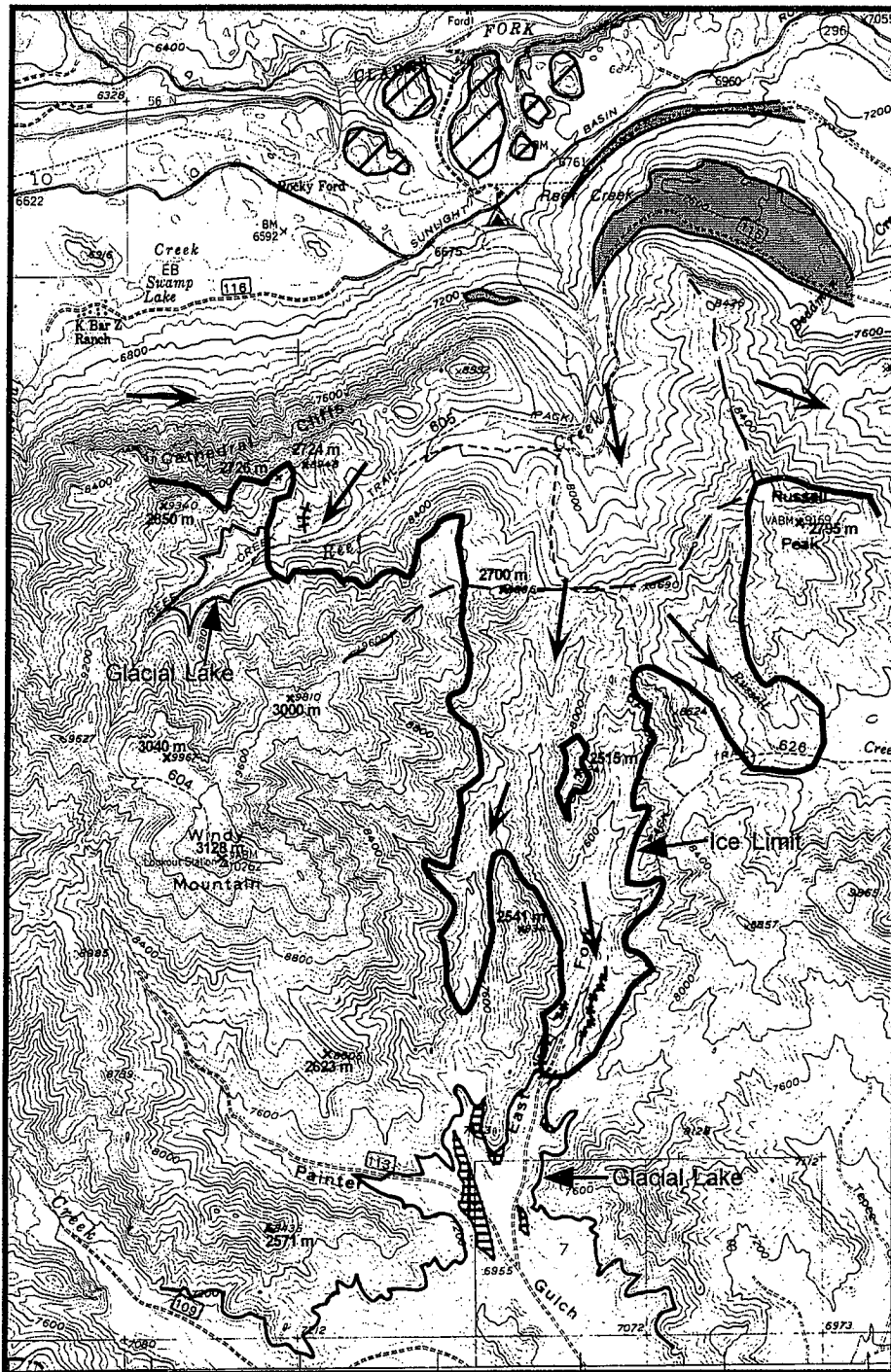


Figure 1. Map of Reef Creek and the Painter Gulch area