

CORRESPONDENCE

The Editor,

Journal of Glaciology

SIR,

Rock glaciers—some comments about age

I wish to make several comments concerning the age of rock glaciers in the San Juan Mountains of Colorado. Work in this region suggests that many rock glaciers may have originated in late Pinedale time, before 10 000 B.P.

Glacial ice apparently disappeared from valleys in the San Juan Mountains before 9 000 B.P. Maher (1972) obtained ages of $15\,450 \pm 220$ B.P. (Y-1147) and $13\,360 \pm 120$ B.P. (Y-1437) for organic material in Molas Lake, at 3 200 m, indicating that the San Juan highland icefield near Molas Divide was dissipated before 15 500 B.P. Radiocarbon dates from bogs within 1 km of the cirque headwalls ($9\,620 \pm 400$, St-3909; $8\,785 \pm 95$, SI-1241; $8\,430 \pm 85$, SI-1558) suggest that ice was confined to north-eastward-facing cirques along the Continental Divide in the San Juan Mountains before 9 000 B.P. (Andrews and others, 1975; Carrara and Andrews, [1976]). The same authors found no evidence of post-alothermal glacial activity in this mountain range.

Many rock glaciers may have originated in late Pinedale time prior to 9 000 B.P. On the basis of pollen analysis and bog stratigraphy (Andrews and others, 1975; Maher, unpublished), it appears that the most severe periglacial climate in Holocene time occurred immediately after Pinedale deglaciation, between 15 000 and 9 000 B.P. Wahrhaftig and Cox (1959) noted that rock glaciers in the Alaska Range approximately 500 m below present snowline are currently active. Hence, during Pinedale deglaciation the perennial snowline may have been above the land surface and yet conditions conducive to formation and/or preservation of rock glaciers may have persisted. In the San Juan Mountains, it is argued that the time immediately after Pinedale deglaciation was the most likely time of origination of rock glaciers. Relative weathering of clasts on several rock glaciers in the San Juan Mountains indicates that the rock glaciers may have originated prior to the alothermal (8 000–5 000 B.P.) (Carrara and Andrews, [1976]). Birkeland (1973) also cited evidence for the formation of Pinedale rock glaciers on Mount Sopris in the Elk Range of Colorado.

The majority of rock glaciers in the San Juan Mountains are presently active. If they were formed in late Pinedale time, as I believe, it is not necessary to assume that they were inactive during the alothermal. The alothermal may not have been significantly warmer than the present in the San Juan Mountains (Andrews and others, 1975; Maher, unpublished). Because rock glaciers are relatively insensitive to climatic change (Potter, 1972), it does not seem likely that they were deactivated during the alothermal. Hence it is suggested that many rock glaciers in the San Juan Mountains are time-transgressive periglacial features that originated during the late Pinedale and have been active to the present.

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30 June 1978

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