Surface Sediment Analysis of a Rock Glacier

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Three trend surface techniques are used to evaluate the nature and distribution of the surface sediments of a rock glacier. Trend surface analysis, vector trend analysis, and most predictable surface (MPS) mapping suggest that long-term rock glacier creep causes the highly variable debris cover to display crude sorting and orientation patterns. Poorly sorted and randomly oriented surface materials may be the result of insufficient time for slowly evolving rock glacier sediment distributions to be established and/or the site of glacial erosion or deposition.

KEY WORDS: Rock glacier, trend surface analysis, vector trend analysis, most predictable surface (MPS) mapping.

INTRODUCTION

Rock glaciers are large glacier-like alpine landforms consisting of rock and ice (Corte, 1976; White, 1976). Although these features may have several characteristic forms and the nature of the ice-rock mixture may vary, all rock glaciers must show evidence of present or past downslope creep (Østrem, 1971; Johnson, 1974).

The chaotic nature of the rock glacier debris mantle does not suggest an order to the distribution of surface sediments. However, scattered accounts (Wahrhaftig and Cox, 1959; Barsch, 1971; Potter, 1972; Barsch, Fierz, and Haeberli, 1979; Giardino, Lawson, and Shroder, 1979) have reported crude sorting and orientation in rock glacier sediments that may be related to the formation or movement of the landform. In this paper three trend surface techniques are used to analyze the surface sediment distribution of one rock glacier. Due to the extremely variable nature of the size and orientation of the lithic fragments, high levels of statistical explanation were neither expected nor obtained. However, consistent trends appear in each analysis suggesting the evolution of the rock glacier.

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THE STUDY AREA

Mount Assiniboine Provincial Park, British Columbia (Fig. 1) was chosen for study because of the range of glacial and periglacial landforms within this small area. Most of the mountains within the park exceed 2700 m, with cirque glaciers, mountaintop glaciers, and small icefields surrounding the higher peaks (Fig. 2). Evidence of a recent Neoglacial advance is present in the form of vegetation-free actively degrading ice-cored moraines found as low as 2200 m. The profusion of cirque basins, moraines, trimlines, glaciofluvial remnants and glaciolacustrine shorelines and lakebeds suggest former widespread glacial activity. Past and present periglacial conditions are indicated by the larger number of talus slopes, some inactive and lichen encrusted, others active and probably ice-cored.

The rock glacier selected for study (Figs. 2 and 3) fits typical descriptions of an active tongue-shaped, ice-cored rock glacier, with numerous longitudinal and transverse furrows and ridges and a large spoon-shaped depression at the head (White, 1976). Although the thick coat of rubble prevented the investigators from reaching the presumed ice-core, the presence of ice is suggested by the formation of a temporary lake in the spoon-shaped depression during spring thaw (Johnson, 1978) and by exposed ice-cores in related landforms located at similar or lower elevations. The rock glacier trends north-south and is approximately 450-m long and 150-m wide. Its surface elevation ranges from 2200 to

Fig. 1. Location of the study area.