

Biafo Glacier

At approximately 853 km² in size, 628 km² of which is permanent snow and ice, Biafo Glacier is one of the largest and longest (68 km if upper-most tributaries are included) of the Karakoram glaciers. It differs from many others in the Himalaya because it is mainly nourished by direct snowfall rather than by avalanching (Hewitt and others, 1989). Biafo Glacier's measured annual snow accumulation rate of approximately 0.6 km³, thickness (perhaps 1.4 km at the equilibrium line), and flow rates of 0.8 m d⁻¹ in summer equate to an annual ice flux through the equilibrium line of 0.7 km³ a⁻¹; this matches stake ablation rates equating to 0.7 km³ a⁻¹. The approximate concordance of the three measurements by Hewitt and others (1989) indicates that the ablation zone of Biafo Glacier, whose area covers about 0.09 percent of the whole upper Indus basin, produces approximately 0.09 percent of the total runoff. The Biafo Glacier has largely linear moraines, and a reported history of considerable fluctuation of its terminus (Mason, 1930; Auden, 1935; Hewitt, 1969; Mayewski and Jeschke, 1979; Hewitt and others, 1989). Some of this variability may be seasonal, but there has been a general retreat of 0.5–1 km in the last 120 years. Perhaps of greater significance, however, are the changes on the upper parts of the glacier. During the Shaksgam expedition, Conway's "Snow Lake" consisted of "mostly bare ice" when it was traversed on 20 August 1937 (Shipton, 1938, p. 325). Close-up and panoramic photographs of the same area by Workman and Workman (1911) taken on 16 August 1908 and by Shipton (1940) on 19 August 1939 show extensive snow and white firn fields over clean ice. Shipton (1940, p. 414) noted that travel on the Biafo Glacier was remarkably easy on 19–21 August 1939 "as the smooth white ice extends from its upper reaches almost to the snout." The expedition map (Mott, 1950) also shows extensive clean ice or firn covering much of the upper two-thirds of the glacier. Only thin lateral moraines occurred along the margins, including a narrow strip about 700–800 m wide on the north side of the Sim Gang part of "Snow Lake." About forty years later, in 1977 and 1979, only a thin band of white ice occurred in the lower third of the glacier, and much of the upper part was dark and debris covered. Even the Sim Gang area, at an elevation of about 5,000 m, has a debris-covered surface up to 2 km wide and 8 km long. People who have trekked across this region in recent years have reported that progress in summer months can be most difficult because much of the Sim Gang firn has become water saturated, in contrast to prior years of easy travel (Searle, oral comm. to JFS, 1988).

The ablation region of Biafo Glacier was once characterized by ice standing high above its lateral moraines and the bounding lateral troughs, or 'ablation valleys', but Hewitt and others (1989) have calculated that the glacier has lost at least 2 km³ of its ice mass between 1910 and 1960. Net annual ice losses due to the wastage of the glacier in the 20th century is estimated to be 0.4–0.5 m a⁻¹, which represents 12–15 percent of the annual water yield from ice melt.

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