

Radiocarbon dating of the last glaciation in Peru

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ABSTRACT

In the Cordillera Vilcanota and the vicinity of the Quelccaya ice cap, near lat 14°S in eastern Peru, the last glaciation culminated sometime between about 28,000 and 14,000 B.P. Alpine glaciers were then only about half as long as during an earlier glaciation of unknown date. A rather minor readvance of the Quelccaya ice cap was in progress about 11,500 B.P. and culminated about 11,000 B.P., some 500 to 800 yr before the Younger Dryas Stade in Europe. By 10,000 B.P., the Quelccaya ice cap was little if any larger than it is today, and it was smaller than it is today between about 2700 and 1600 B.P. Glacier fluctuations during the interval 10,000 to 3000 B.P. have not yet been determined. A "Little Ice Age" maximum culminated between 600 and 300 B.P. The relative importance of changes in temperature and precipitation in causing these glacier variations is uncertain.

INTRODUCTION

In tropical regions the chronology of glacier variations during and since the last major glaciation is poorly known, and the degree of synchrony between events in tropical and temperate latitudes remains in doubt. The most detailed chronology is from New Guinea, but many dates from there are estimates obtained by extrapolation from horizons not directly associated with a glacial event. The last glaciation in New Guinea is believed to have culminated about 15,000 B.P. (Hope and others, 1976) or about 24,000 B.P. (Löffler, 1972). In Hawaii, the last glaciation culminated sometime between about 22,000 and 9100 B.P. (Porter, 1977), and in tropical Africa shortly before 15,000 B.P. (Livingstone, 1967). In tropical South America, only minimum ages have previously been obtained for the last glaciation, showing that in Venezuela it culminated before about 9000 B.P. (Schubert, 1972), in Colombia before about 12,300 B.P. (Gonzales and others, 1965) and before about 13,800 B.P. (Herd and Naeser, 1974), and in Peru before 9500 B.P. (Cardich, 1964). In Peru, Tircart (1965) noted that some glacial features appeared to predate the last glaciation, but Clapperton (1972) concluded that in central Peru all the moraines were of late Wisconsin-Weichsel age or younger.

We are investigating the glacial history of the Cordillera Vilcanota and the adjacent Quelccaya ice cap, in the eastern cordillera of Peru (Fig. 1; Table 1). Some observations on the glacial geology of the Cordillera Vilcanota were made in 1965 in the course of a regional geological survey (Audebaud, 1973). Our field

work began near the Quelccaya ice cap in 1974 (Mercer and others, 1975) and continued in 1976 both there and in the Cordillera Vilcanota, as part of a multidisciplinary study that includes ice stratigraphic (Thompson and Dansgaard, 1975) and meteorological studies on the ice cap.

The extensively ice-covered Cordillera Vilcanota extends 50 km east-west near lat 13°45'S, its eastern peaks bordering the western margin of the Amazon Basin. The range is rugged and composed of a wide variety of granitic, volcanic, and sedimentary rocks (Audebaud, 1973). The highest peak is Nevado Ausangate (6,384 m). Most glaciers are short, steep, and highly crevassed; they terminate close to 4,600 m on the north side of the range, where the equilibrium line is at about 5,100 m. The Quelccaya ice cap is, except for the very small Northwall firn in New Guinea (Hope and others, 1976), the only ice cap within the tropics. It is situated just south of the eastern end of the Cordillera Vilcanota and covers an ignimbrite plateau bounded by an escarpment over which short, steep outlet glaciers flow to as low as 4,950 m on the western side. The ice cap covers 70 km², and the highest of four domes reaches 5,645 m. On the west side the equilibrium line lies at about 5,300 m.

In the area of the Cordillera Vilcanota-Quelccaya ice cap the annual temperature range is small, but precipitation is markedly seasonal, being heaviest in southern summer when the Intertropical Convergence Zone is south of the equator. As a result, summer is the accumulation season on glaciers, and the snowline is highest at the end of winter.