SHORT PAPERS

Radiocarbon Dates on Deglaciation, Cordillera Central, Northern Peruvian Andes

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Three radiocarbon dates along with relative-dating criteria place limits on the deglaciation history of Manchaque Valley, Cordillera Central. Ice retreated from the late-glacial maximum by at least 12,100 yr B.P. During ice retreat numerous moraines were deposited throughout the valley. Glacier cover was reduced to about half that of the last glacial maximum by at least 9700 yr B.P. and to less than a tenth by at least 6450 yr B.P. Because all dates are minimum, the dates and field data are consistent with little or no ice remaining by early Holocene. No unambiguous Younger Dryas moraines are present.

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INTRODUCTION

Clapperton (1983) and Mercer (1983) have recently reviewed glacial chronologies for the Peruvian Andes. In Peru there are two areas in which a late-glacial chronology has been established with reasonable radiocarbon dating control; these are the Junin Plain area at ca. 11°S (Wright, 1983, 1984) and the Cordillera Vilcanota-Queqecaya ice cap at ca. 14°S (Mercer and Palacios, 1977). In contrast, late-glacial deposits in the northern half of the Peruvian Andes are poorly dated. Here we report radiocarbon dates that provide information on the timing of deglaciation in the Cordillera Central (7–8°S) of northern Peru.

SETTING

The part of the Cordillera Central studied is the Manchaque Valley in which streams drain eastward from the local divide to the Rio Marañon in the Amazon Basin (Fig. 1). Bedrock geology is poorly known but it is mainly granitic and metamorphic (quartzite) rocks. The highest peaks are near 4500-m elevation, and glaciers are absent. Grasses, herbs, and shrubs comprise the paramo vegetation of most of the valley (Weberbauer, 1945; Tosi, 1960). The western edge of the Amazon rain forest reaches into the upper end of Manchaque Valley, and the present paramo-forest boundary is maintained by periodic burning. Climatic data are not available, but annual rainfall is estimated to be at least 2 m (K. R. Young, personal communication, 1988).

The lower limit of glaciation in this part of the Andes is easily delineated by a down-valley change in valley morphology from low-gradient U shapes to steep-gradient V shapes. Numerous well-preserved moraines are present throughout the 13-km-long glaciated portion of Manchaque Valley (Fig. 1). Most of the moraines rise about 10 m or less above the valley floor, have crests about 3 m wide, and have steep proximal and distal slopes of between about 25° and 35°. Morphologically, we recognize this set of moraines, and none distinctly older or younger. Relative-dating studies (cf. Birkeland et al., 1979) reveal that soils at the summits of moraine crests are similar—A/Bw/Cox profiles with the A horizons formed from loess and the deeper horizons in till—and that the degree of clast weathering is similar on all moraines. From this we conclude that all of the moraines,
Fig. 1. Map of Manachaque Valley showing moraines (dashed lines) and the dated localities (dates in ¹⁴C yr B.P.). Lake names are informal.

including those furthest upvalley, are of one age group, which we tentatively assign to the last glaciation.

**RADIOCARBON DATES**

Three radiocarbon dates help constrain the ages of moraines in the valley (Table 1; Fig. 1). A date from the base of easily penetrated lake sediment from a core in Laguna Baja is 12,100 yr B.P., thus providing a minimum age for initial deglaciation of Manachaque Valley. About 3 km upvalley from Laguna Baja is the next-youngest moraine in the valley; the ice-covered area then was about 50% that of the glacial maximum. A date of 9700 yr B.P. obtained from the base of a bog on the upvalley side of the moraine provides a minimum age for subsequent glacier recession. Numerous moraines are present upvalley from this locality. A date of 6450 yr B.P. was obtained from the base of a bog just upvalley from the youngest moraine in the valley that contains Laguna Larga. The date suggests that at least by middle Holocene time little ice remained (<10% that of the area covered during the glacial maximum).

The dates are all minimum ages. The moraine downvalley from each dated locality is older than the radiocarbon age by an unknown amount, and each date provides a minimum radiocarbon age for the disappearance of ice from that part of the valley. We have no way of estimating what the maximum ages of the moraines might be. One interpretation that is compatible with both the dates and the relative-age data is that deglaciation began before 12,000 yr B.P. and that ice withdrew fairly rapidly, depositing numerous moraines. There is no compelling evidence to suggest that glaciers were present in any but the earliest part of the Holocene.

The moraine in front of the site of the 9700-yr-old radiocarbon date could be a local candidate for a correlative of the Younger Dryas moraines of Europe (ca. 11,000 to 10,000 yr B.P., e.g., Mangerud et al., 1979). Perhaps the best evidence for a glacier advance within this span of time in

<table>
<thead>
<tr>
<th>Sample No.</th>
<th>Age (yr B.P.)</th>
<th>Description</th>
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<tbody>
<tr>
<td>GX-13790</td>
<td>6,450 ± 150</td>
<td>Disseminated organic matter in basal 5 cm of 110-cm-thick organic sediment that overlies till in a stream cut. Locality is within several tens of meters upvalley from the youngest moraine in the valley that contains Laguna Larga.</td>
</tr>
<tr>
<td>GX-12853</td>
<td>9,700 ± 270</td>
<td>Disseminated organic matter in basal 5 cm of 140-cm-thick organic sediment that overlies glacial or fluviatile sediment, within several tens of meters upvalley from the first moraine upvalley from Laguna Baja.</td>
</tr>
<tr>
<td>GX-12854</td>
<td>12,100 ± 190</td>
<td>Disseminated organic matter in basal 5 cm of 428-cm-thick lake sediments retrieved by coring Laguna Baja. These are interpreted to be basal lake sediments overlying till (?).</td>
</tr>
</tbody>
</table>

*All dates are based on the Libby half-life of 5570 yr. Pretreatment included handpicking rootlets and concentration of organic matter at the INSTAAR Sedimentology Laboratory (method of Rolf Kihl, p. 90 in Andrews, 1975).*
the Andes is in Ecuador (ca. 2°S), where Clapperton and McEwan (1985) have radiocarbon dates for samples of sediment laid down when ice advanced to block a valley. In the Peruvian Andes, Mercer and Palacios (1977) report a readvance of the Quelccaya ice cap that culminated about 11,000 yr B.P. Because of the possible Younger Dryas age of the moraine in front of the site of the 9700-yr-old radiocarbon date reported here, we dug extensive trenches at the base of the moraine in search of a buried soil or organic matter. A buried soil was not found; therefore, a readvance cannot be proved, and the above-date remains only a minimum date for the moraine.

RELATIONSHIP TO OTHER DATES IN PERU

Wright (1983, 1984) has developed a radiocarbon-dated chronology for the Junin area. One set of moraines is dated at >42,000 yr B.P.; this is the oldest minimum date for moraines in Peru. The next younger glaciation in the Junin area began about 24,000 yr B.P. and deglaciation had begun by about 12,000 yr B.P. According to Mercer and Palacios (1977), dates from the Cordillera Vilcanota suggest that the last glaciation began after 28,500 yr and that deglaciation had commenced at least by 12,240 yr B.P. These dates, along with the basal lake sediment date we report here, suggest that regional deglaciation of the Peruvian Andes was underway by about 12,000 yr B.P.

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REFERENCES


