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Last Glacial Maximum to near present ^{10}Be chronology of the Universidad glacier fluctuations in the Subtropical Chilean Andes (34° S): paleoclimate implications

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The geochronological and geomorphological reconstruction of glacier fluctuations is required to assess the timing and structure of climate changes of the last glacial cycle in the subtropical Andes of Chile. The scarcity of data in this region limits the knowledge related to the timing of glacial landscape changes during this long-term period. To provide a new framework to better understand the climate history of the semiarid Andes of Chile, we have reconstructed the glacial history of the Universidad glacier (34° S).

Our mapping shows the existence of four moraine belts (UNI I to UNI IV, from outer to inner) that are spatially unequally distributed along the 13 km of the valley between ~2500 and ~1400 m a.s.l. We applied ^{10}Be cosmogenic surface exposure dating to 26 granodioritic boulders on moraines and determined the age of the associated glacial advances. UNI I moraine represents the distal glacier advance between 20.8 ± 0.8 and 17.8 ± 0.8 kyr ago (number of ^{10}Be samples = 11). Other two significant glacier advances terminated one and four km up-valley from the UNI I moraine, respectively, formed 16.1 ± 0.9 kyr ($n=1$) (UNI II) and 14.6 ± 1 to 10 ± 0.5 kyr ago ($n=3$) (UNI III). A sequence of six distinct and smaller moraine ridges has been identified in the proglacial area. They are part of last significant glacier advances labeled as UNI IV. The four distal ridges have been dated to between 645-150 years ago ($n=11$), while the most proximal moraines coincide with mid-20th century and 1997 aerial photographs.

The results indicate that the Universidad glacier advanced during the Last Glacial Maximum (LGM) (UNI I). Deglaciation was punctuated by glacier readvances during the Late Glacial when the UNI II and UNI III moraines were deposited. Finally, UNI IV moraine shows six glacier fluctuations developed between the 14th and 20th centuries.

Our data suggest that the glacier advances by the Universidad glacier were triggered by intensified southern westerly winds bringing colder and wetter conditions to subtropical latitudes in the SE Pacific. Moreover, our data indicate that more or less in-phase Late-Glacial advances along the

tropical and extratropical Andes occurred. We discuss different climate forcings that explain these glacier changes. Finally, we illustrate the influence of the “Little Ice Age” in the Semiarid Andes.