

LATE GLACIAL AND HOLOCENE GLACIATION IN TIERRA DEL FUEGO

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This report summarises the fieldwork conducted by Carla Huynh, Andy Hein, Rob Bingham and Juan-Luis García in Tierra del Fuego in November and December 2023 as part of Carla Huynh's ongoing Ph.D. research at the University of Edinburgh.

Background and Rationale

Tierra del Fuego, the archipelago of remote islands in

southern Patagonia, intersect the core of the Southern Westerly Winds (SWWs), which play an important role in global climate. The region experiences very unique climatic conditions and as the most southerly continental landmass outside Antarctica, it is an interesting region for studying past glacier change. During the global Last Glacial Maximum (gLGM), a large outlet glacier of the former Patagonian Ice Sheet extended nearly 200 km down the Straits of

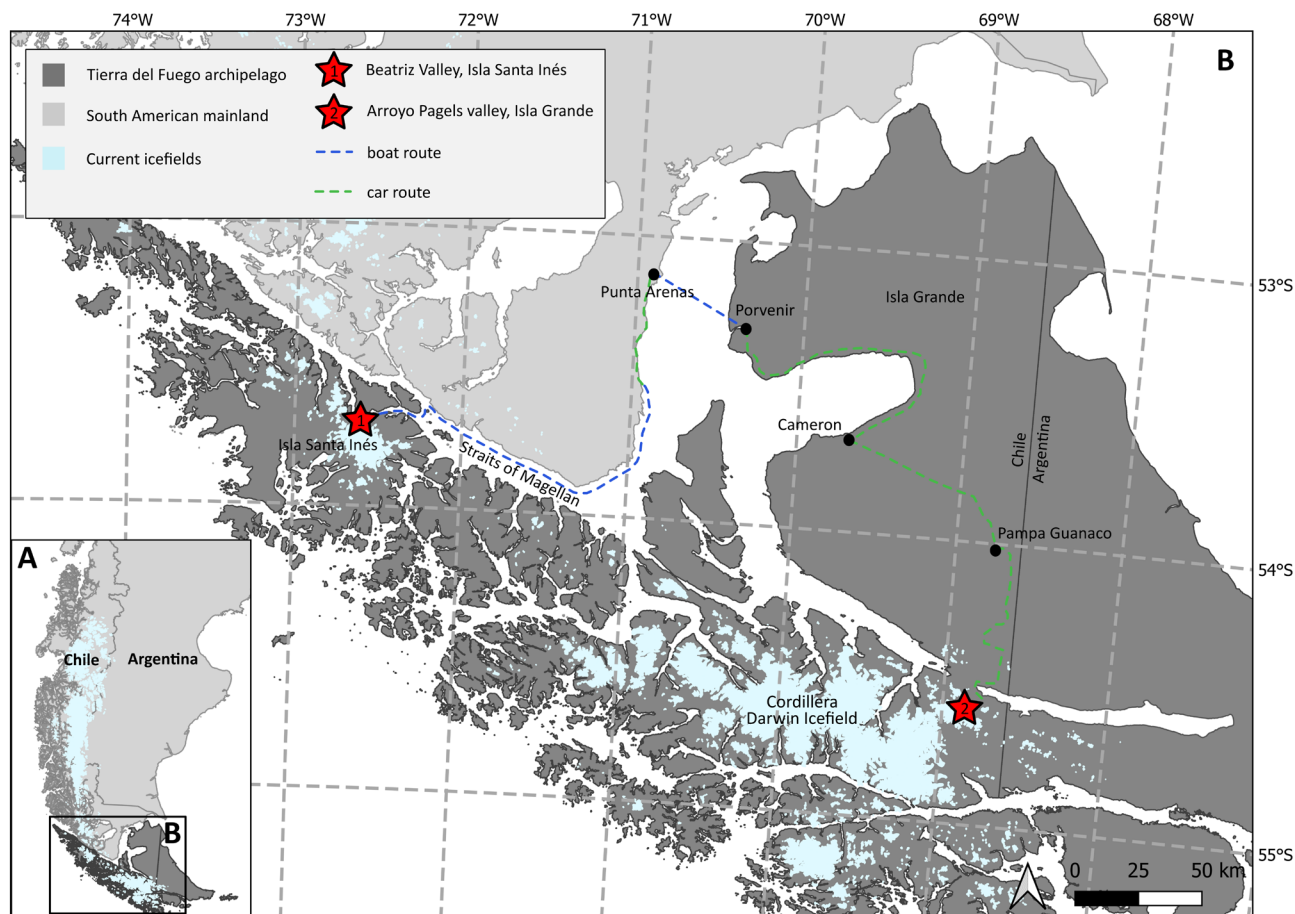


Figure 1. (A) Location of Tierra del Fuego, an archipelago of islands in southernmost Patagonia. (B) Our two study regions in the Tierra del Fuego archipelago and the route travelled.

Magellan, the body of water that separates Tierra del Fuego from the South American mainland. The gLGM ice extent in the region is well understood because it is underpinned by significant previous research (e.g. Clapperton *et al.*, 1995; Coronato and Rabassa, 2011; Darvill *et al.*, 2015a; 2015b; Kaplan *et al.*, 2007; 2008; McCulloch *et al.*, 2005; Peltier *et al.*, 2021; Rabassa *et al.*, 2000). However, a series of small moraines just a few kilometres outside the present-day ice extent are less well studied because scientists seldom visit the islands surrounding the Santa Inés and Cordillera Darwin Icefields. The islands of Tierra del Fuego are remote and experience challenging weather conditions, making the islands logistically difficult to access. These moraines, which we believe were deposited during the Late Glacial or Holocene, are interesting because they record a past glacier re-advance, during a period of time generally characterised by warmer and wetter conditions than

the preceding glacial period. By constraining the timing of their deposition, we can better understand past environmental conditions on these remote islands.

Methods and results

In order to constrain the timing of these glacial re-advances, we conducted fieldwork in two regions that experience contrasting environmental conditions today (Figure 1). Site 1, the Beatriz valley on the northern margin of the Santa Inés Icefield, is situated on the western side of the Andes mountain chain and hence experiences very high annual precipitation. Here, the low-lying glacial foreland was characterised by peat bog, the moraines were covered in a dense *Nothofagus betuloides* forest and the moraine boulders were buried under a thick layer of moss. We collected 13 rock samples from this site which were

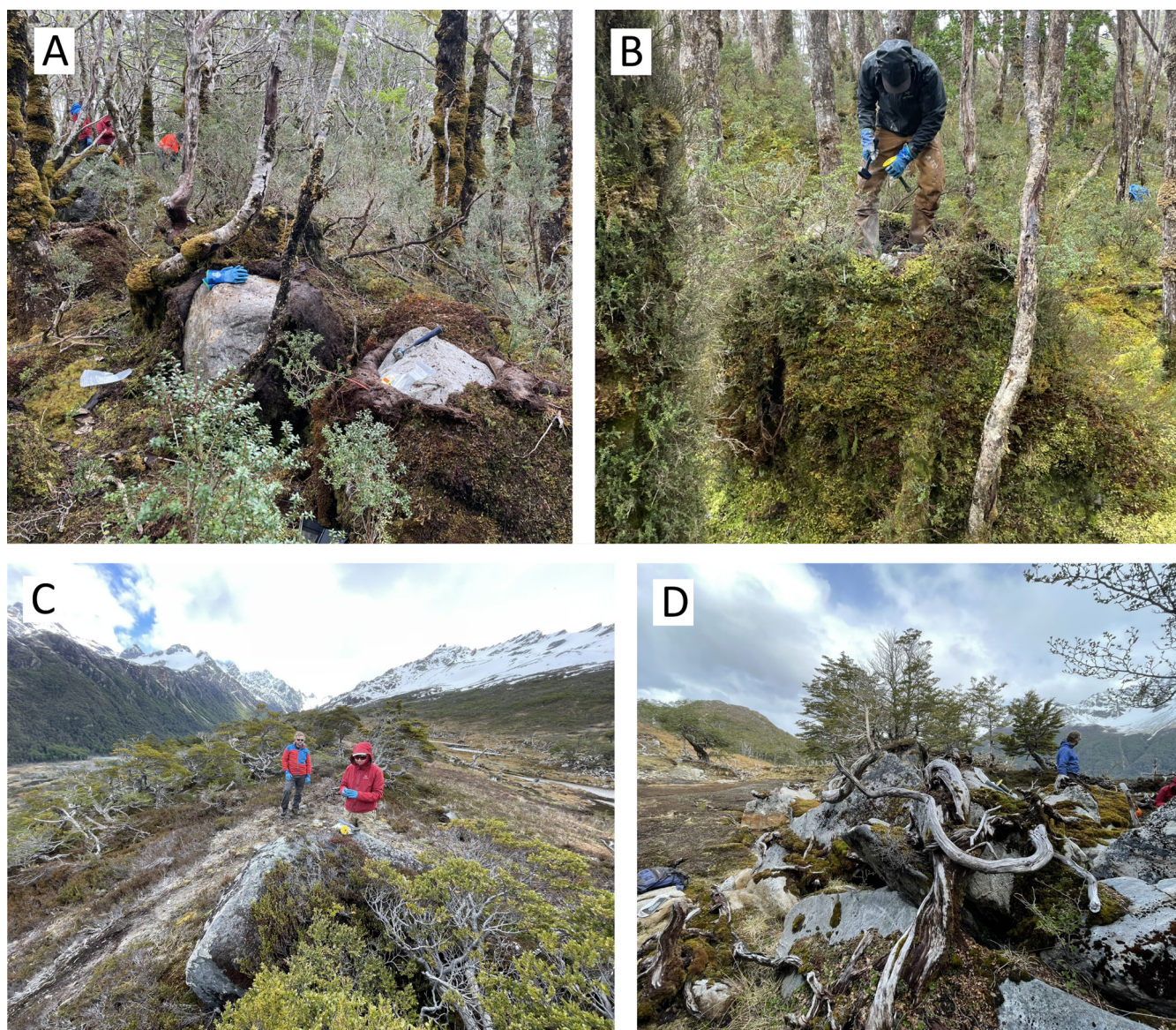


Figure 2. (A) Boulders on the prominent ‘B1’ moraine in the Beatriz valley were covered in a moss layer up to 10 cm thick. (B) Boulders outboard of the ‘B1’ moraine were even more vegetated, with 20 cm thick moss cover. (C) and (D) Boulders from moraines in the drier Arroyo Pagels valley had only thin and patchy moss cover, with trees growing between and on top of the boulders in some locations.

comprised of 6 boulder samples from the prominent, inner 'B1' moraine, 5 boulder samples from an outer densely vegetated moraine and two bedrock samples outboard of these to give us a minimum age constraint for deglaciation.

Site 2, the Arroyo Pagels valley on the eastern margin of the Cordillera Darwin Icefield, is ~250 km to the south-east and in the shadow of the Andes, experiencing considerably lower annual precipitation. Here, the valley is greatly modified by the non-native North American beaver, with peat bogs punctuated by beaver dams and dense woodland that has been partly cleared by beaver felling. We collected 21 moraine boulders from three regions within the valley: 9 from prominent left-lateral moraines at ~400 m a.s.l. on the northern flank of the valley, 7 from a series of smaller cirque moraines on the southern flank and 5 from a moraine in the valley bottom ~2 km from the head of the valley. The varying degrees of tree growth on and around the moraine boulders suggest that at least 2-3 periods of glaciation are recorded in the sampled moraines, likely spanning from the Late Holocene to the Early Holocene/Late Glacial.

Significance

The difference in vegetation cover and peat development between different moraine crests in both valleys studied suggests there may have been a significant time gap between their deposition (Figure 2). This is interesting because it suggests multiple periods of cooling and/or increased precipitation that was sustained enough to drive glacial re-advances and stabilisation during the Late Glacial and Holocene periods. The 34 rock samples collected will now be dated using cosmogenic nuclide exposure dating in order to reconstruct the Late Glacial and Holocene glacial history on these remote islands. This glacial reconstruction will then be used alongside numerical glacier modelling to better understand the climate required to drive these glacial re-advances.

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