



Morphologic characterization of giant flood deposits downriver landslide dams in the Northern Patagonian Andes

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In northern Patagonia, a landslide dam blocking Barrancas river failed on Dec. 29, 1914 and a water volume of 1.55 km³ was released from the lake causing a gigantic flow, which destroyed lowlands in the Barrancas and Colorado valleys down to the Atlantic. In addition, in the Pichi Neuquén valley, 80 km west of the previous case, flood deposits indicate the prehistoric partial collapse of the Laguna Navarrete. Morphologic characteristics of both landslide dam failures are similar and provide: A) a several-meter-wide paleoshoreline eroded into the valley slopes upriver the failed dam at 85 and 40 m above the valley floor, respectively, B) a deeply incised steep-walled canyon eroded into the landslide deposit, C) a boulder deposit more than 10 m thick inundating the entire valley and extending for several tens of kilometers downriver the collapsed dam, D) a gouge eroded into the boulder deposit, and E) a small relictic lake behind the failed dam.

These characteristics contrast to another flood deposit downriver a landslide dam in the Ñireco valley forming the Ñireco lake, 100 km south of the Pichi Neuquén valley. The landslide is a rotational slide with a surface area of 2.4 km². Even though the associated flood deposit also spans the entire width of the valley floor, it is only 1.2 km long, no canyon has been eroded into the landslide dam, nor is there a gouge cutting the flood deposit or a paleoshoreline upriver the dam. In contrast, on its surface there are various flat, poorly eroded abandoned channels. In addition, a landslide deposit of the toppling type lies within the Ñireco lake. This extends for 1.3 km and is less eroded than the landslide dam deposit. Hence, we interpret that the toppling failure was pos-

terior to the creation of the dam, and thus the landslide fell into the lake triggering a tsunami wave that run over the landslide dam, forming the restricted flood deposit without causing a catastrophic failure of the dam. This interpretation is supported by preliminary ^3He surface exposure ages of olivine indicating that the landslide dam has an age of 3700 ± 350 yr and the toppling failure occurred at 2700 ± 700 yr (1 sigma uncertainty levels).

Another rock avalanche deposit is located 8 km to the north in the Reñileuvu valley, lining up along the same fault segment as the rotational slide in Ñireco valley. This deposit has a ^3He surface exposure age of 3800 ± 650 yr, synchronous with the age of the Ñireco landslide dam, suggesting that these large landslides may have been triggered by strong earthquakes along that fault.

Our morphological observations may help to reconstruct the erosion histories of further paleolandslide dams in the Patagonian Andes or in other mountain areas, where interpretation of the failure mode is based on fewer observations.