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Neoglacial increase in high-magnitude Glacial Lake Outburst Flood frequency (Baker River, Patagonia, 47°S)

Sebastien Bertrand¹, Elke Vandekerckhove¹, Dmitri Mauquoy², Dave McWethy³, Brian Reid⁴, Sarah Stammen¹, Krystyna Saunders⁵, and Fernando Torrejon⁶

¹Renard Center of Marine Geology, Ghent University, Gent, Belgium (sebastien.bertrand@ugent.be)

²School of Geosciences, University of Aberdeen, Aberdeen, United Kingdom

³Department of Earth Sciences, Montana State University, Bozeman, USA

⁴Centro de Investigación en Ecosistemas de la Patagonia (CIEP), Coyhaique, Chile

⁵Australian Nuclear Science and Technology Organisation, Lucas Heights, Australia

⁶Centro EULA, Universidad de Concepción, Concepción, Chile

Glacial Lake Outburst Floods (GLOFs) constitute a major hazard in periglacial environments. Despite a recent increase in the size and number of glacial lakes worldwide, there is only limited evidence that climate change is affecting GLOF frequency. In Patagonia, GLOFs are particularly common in the Baker River watershed (47°S), where 21 GLOFs occurred between 2008 and 2017 due to the drainage of Cachet 2 Lake into the Colonia River, a tributary of the Baker River. During these GLOFs, the increased discharge from the Colonia River blocks the regular flow of the Baker River, resulting in the inundation of the Valle Grande floodplain, which is located approximately 4 km upstream of the confluence. To assess the possible long-term relationship between GLOF frequency, glacier behavior, and climate variability, four sediment cores collected in the Valle Grande floodplain were analyzed. Their geophysical and sedimentological properties were examined, and radiocarbon-based age-depth models were constructed. All cores consist of dense, fine-grained, organic-poor material alternating with low-density organic-rich deposits. The percentage of lithogenic particles, which were most likely deposited during high-magnitude GLOFs, was used to reconstruct the flood history of the last 2.75 kyr. Results show increased flood activity between 2.57 and 2.17 cal kyr BP, and between 0.75 and 0 cal kyr BP. These two periods coincide with glacier advances during the Neoglaciation. Our results suggest that GLOFs are not a new phenomenon in the region. Although rapid glacier retreat is likely responsible for high GLOF frequency in the 21st century, high-magnitude GLOFs seem to occur more frequently when glaciers are larger and thicker.