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New Late Glacial and Holocene ^{36}Cl and ^{10}Be moraine chronologies from sub-Antarctic Kerguelen Archipelago

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The Kerguelen Archipelago (49°S, 69°E) is an excellent location for the study of multi-millennial glacier fluctuations, since it is the largest still glaciated emerged area (552 km^2 in 2001) in the sub-Antarctic sector of the Indian Ocean, where many glacio-geomorphological formations such as moraines may be dated. To investigate the so-far little-known Late Glacial and the Holocene glacier fluctuations in Kerguelen, we apply cosmogenic nuclide dating of moraines in 3 glacial valleys: Val Travers valley, Ampere glacier valley and Arago glacier valley. We use in situ ^{36}Cl dating of the basaltic moraine boulders at the first two sites, and ^{10}Be dating of the quartz-bearing syenite boulders at the third site. The new ^{36}Cl and ^{10}Be exposure ages provide time constraints over the last 17,000 years. A glacial advance was highlighted during the Late Glacial at 14.4 ± 1.4 ka ago, probably linked to the Antarctic Cold Reversal event. These results are consistent with those previously obtained on the archipelago (Jomelli et al., 2017, 2018; Charton et al., 2020) and more generally those from other the sub-Antarctic regions (*e.g.* Sagredo et al., 2018). This suggests that all glaciers at this latitude were broadly sensitive to this specific climatic signal. No Early nor Mid Holocene advances were evidenced in Kerguelen glacier evolution during the Holocene due to missing moraines that may have formed in these specific periods. Radiocarbon-dated peat, published in the 1990s, provides evidence of less extensive glacier extents during the Early Holocene than during the Late Holocene (Frenot et al., 1997). Finally, glaciers seem to have re-advanced only during the Late Holocene, especially within the last millennium, at □1 ka, □620 years and □390 years (Verfaillie et al., submitted). A comparison of this new dataset with the available ^{10}Be ages from other sub-Antarctic regions allows for the identification of 3 different glacier evolution patterns during the Holocene. The glacial fluctuations experienced by Kerguelen glaciers seems particularly uncommon, and are likely due to its singular location in the Southern Indian Ocean. Finally, climatic factors that may explain the Kerguelen glacier evolution (temperature, precipitation) are discussed. To this end, we investigate the chronology of glacier advance/retreat

periods with *(i)* the variation in atmospheric temperatures recorded in ice cores in Antarctica and *(ii)* the variation in precipitation (Southern Westerly Winds, Southern Annular Mode).

Charton et al., 2020 : Ant. Sci. 1-13

Frenot et al., 1997 : C.R. Acad. Sci. Paris Life Sciences 320, 567-573

Jomelli et al., 2017 : Quat. Sci. Rev. 162, 128-144

Jomelli et al., 2018 : Quat. Sci. Rev. 183, 110-123

Sagredo et al., 2018 : Quat Sci. Rev. 188, 160-166

Verfaillie et al., submitted