Multi-nuclide dating (36Cl, 10Be, 26Al) in a volcanic-dominated environment to reconstruct glacier chronologies on Kerguelen Archipelago (49∘S)

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Résumé

To assess the current and future evolution of southern hemisphere glaciers, it is necessary to study their past evolution when human influence was negligible. Cosmogenic nuclide dating of glacial landforms on the Kerguelen Archipelago (49∘S, 69∘E), within the Indian sector of the Southern Ocean, allows to reconstruct multi-millennial glacier fluctuations and understand the associated climate drivers. Until recently, dating of Kerguelen's glacial surfaces was performed using chlorine-36 (36Cl) only, owing to the archipelago's dominantly volcanic lithology. Basaltic whole rock or minerals poor in natural chlorine (feldspars) were preferentially targeted for 36Cl dating. This technique is adapted for most regions of the archipelago, except where plutonic rocks are rich in natural chlorine, leading to high dating uncertainties. This is the case for the Rallier du Baty Peninsula in the southwest of the archipelago. Luckily, the syenites in this region also contain a small amount of quartz, enabling complementary beryllium-10 (10Be) and aluminium-26 (26Al) analyses. We thus used for the first time these three in situ-produced cosmogenic nuclides to date geomorphic features and provide time constraints on the glacial evolution over the last 17,000 years of the Kerguelen Islands (Charton et al., 2022). The pilot data set tentatively indicates that Late Glacial advances occurred at 16.0 ± 1.9 ka and at 12.9 ± 1.7 ka in Val Travers, and at 13.6 ± 1.8 ka in Arago Glacier valley, both probably linked to the Heinrich Stadial 1 (17.5-14.7 ka) and/or Antarctic Cold Reversal (14.5-12.9 ka) events, respectively. This suggests that all glaciers in this region were broadly sensitive to the large-scale climatic signal of the Antarctic Cold Reversal. Up to date, no Early nor Mid-Holocene moraines have been found in the glacial valleys on the Kerguelen Archipelago, indicating a potentially significant glacier retreat during these periods. This pattern is quasi-unique and highlights the non-uniformity of Holocene glaciers' behavior throughout southern mid-latitudes. Here we will present upcoming complementary multi-nuclide analyses of boulders collected on Rallier du Baty Peninsula, which should help further refine Late Glacial and Holocene glacier fluctuations in the Indian sector of the Southern Ocean.

Mots-Clés: past glacier evolution, cosmogenic nuclide dating, Subantarctic, Kerguelen archipelago