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Rock alteration in cold climate: implications from geochemical analysis of river and soil samples from the Kerguelen Archipelago

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The Kerguelen archipelago offers the opportunity to study the alteration processes on magmatic rock in cold climate in contexts little impacted by anthropic activities. A sampling campaign of rivers and soils of this archipelago was carried out in 2019/2020 (Talisker Project- IPEV- France) to analyze geochemical composition of rivers and soils in four different geographical regions, marked by significant climatic (mainly rainfall) and lithological (basalts with intrusions of more or less differentiated rocks) contrasts: Mont des Châteaux river, Armor peninsula rivers, Mont des Ballons rivers, Geography peninsula hydrological system.

The results show significant variations of almost one order of magnitude in the concentrations of major elements in the analyzed waters. The data also show a fairly clear typology of the chemical composition of the waters according to the studied geographical area. At the scale of the archipelago, these variations cannot be explained by a variable rainfall contribution from one region to another. Nor can they be explained by the mere diversity of drained lithologies and the variation of their distribution from one region to the other. We propose that the geomorphological context of the rivers is a parameter to be taken into account to explain their geochemical variation in such volcanic regions under sub-polar oceanic climate. More specifically, our data may indicate that an important part of rock weathering occurs in the valley bottom colluvial zones and that at the scale of this archipelago, chemical weathering and mechanical erosion processes are quite strongly spatially decoupled in the watershed. These first data lead us to propose a conceptual scheme of the dynamics of weathering and erosion processes at the scale of the archipelago, certainly applicable to other subpolar contexts, which now needs to be further tested.