Numerical study of weathering fluxes at the catchment scale in a boreal watershed: A coupled thermo-hydro-geochemical mechanistic approach

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This work deals with the assessment of the impact of the climatic changes on weathering processes in boreal catchments which are characterized by the occurrence of a continuous permafrost. The two main goals of this study are : (i) to quantify the influence of seasonal cycles of freezing and thawing of the active layer on the fluxes of chemical elements generated by the weathering processes and (ii) to estimate the effect on the weathering fluxes of possible interannual variations of these cycles caused by climatic changes. Our approach is based on the development and the validation of a coupled thermo-hydrological mechanistic modelling at the catchment scale for current climatic conditions. This thermo-hydrological model is designed to give the entrance data (the seasonal evolutions of the average thickness and of the average water content of the active layer) for the computation of weathering fluxes with the WHITCH geochemical model (e.g. [1]). This modelling approach at the catchment scale is established on the basis of the data available in the International Research Group CAR WET SIB ([2], [3]). In further studies, the model developed here will allow to forecast the impact of various scenarios of climatic changes on the weathering fluxes.

[1] Goddéris *et al*. (2006) *Geochim. Cosmochim. Acta* **70**, 1128–1147. [2] Bagard *et al*. (in press) *Geochim. Cosmochim. Acta*. [3] Pokrovsky *et al*. (2005) *Geochim. Cosmochim. Acta* **69**, 5659–5680.

Geochronological fingerprint revealed the evolution of the crust underlying Cerro Pampa adakite, Argentine Patagonia

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We reports the results of U-Pb dating for 282 zircon crystals separated from a Middle Miocene adakite in Cerro Pampa, southern Argentine Patagonia, using LA-ICP-MS. With the exception of 3 spot ages, 140 of the concordia ages are significantly older (> 94 Ma) than the cooling ages of the adakite magma (~ 12 Ma). Kay *et al*. [1] attributed the origin of adakite magmas to partial melting of subducted slab of the Nasca plate. Presence of exotic zircon crystals clearly indicates crustal contaminations to produce the adakitic magma in Cerro Pampa. The obtained concordia ages of exotic zircons range from 94 Ma to 1441 Ma and could be divided into five groups having distinctive peaks on a population diagram. The first (100-125 Ma) and second age groups (125 to 145 Ma) correspond to the age of plutonic activities that formed main body of the South Patagonian Batholith [2]. The third to fifth groups correspond to activities of El Qumado-Ibañez volcanic complex (145-170 Ma) [2], gabbroic rocks scarcely distributed in Central Patagonia (170-200 Ma), and the Eastern Andean metamorphic complex of Late Paleozoic to Early Mesozoic ages (200-380 Ma) [3], respectively.

Our data suggests that the crust underneath Cerro Pampa were mostly formed after 380 Ma and majority of the upper crust was formed during early Cretaceous to middle Jurassic. The processes of crustal development ceased ~ 94 Ma until the activity of the Cerro Pampa adakite in ~ 12 Ma. There was no evidence for Archean-Paleoproterozoic crust.

[1] Kay *et al*. (1993) *J. Geol*. **101**, 703–714. [2] Herve *et al*. (2007) *Lithos*, **97**, 373–394. [3] Bahlburg *et al*. (2009) *Earth-Sci. Rev*. **97**, 215–241.