The subduction role in the nitrogen transport to the Deep Earth

D. G. CEDEÑO[1*], R. V. CONCEIÇÃO[1*], M. R. W. DE SOUZA[1] AND L. C. CARNIEL[12]

[1]Laboratório de Geologia Isotópica, IGEO/ UFRGS, Porto Alegre, Brasil ([*]daniel.gringscedeno@gmail.com; [*]rommulo.conceicao@ufrgs.br)

[2]Institut für Mineralogie, Universität Münster, Münster, Germany

It is not a new information that our Planet has more nitrogen than it should have, compared to the other terrestrial planets in the Solar System [1]. Our atmosphere is anomalously enriched in this volatile element [2]. It is unknown, however, how the nitrogen in the atmosphere is transferred to the Deep Earth [3] and how the endogenous and exogenous cycle of nitrogen operates, although we know that some mantle minerals and even the core (due to nitrogen slightly calcophile behavior [4]) are capable to retain significant amounts of nitrogen [5].

The most intriguing part of the overall nitrogen cycle is the connection between the atmosphere and the mantle. How could nitrogen descend to astenospheric or even deeper levels? We believe that clay minerals (such as smectites) could be able to convey nitrogen from the surface to the deep Earth in a subduction zone setting. In order to follow this idea, we are performing HPHT experiments on clay minerals doped with nitrogen in its ammonium (NH_4^+) form. These experiments are conducted on a 1000 tonf hidraulic press, with varied temperatures (from room temperature to 700ºC) and pressures from 2.5 to 7.7 GPa; and on a diamond anvil cell at pressures up to 12 GPa at room temperature. FTIR and XRD analysis are performed in *in situ* and *ex situ* runs. .

Our first results suggest that smectite could be able to retain nitrogen in its NH_4^+ form under 4 GPa and temperatures up to ~250°C. Above this temperature, smectite changes gradually to a Illite-Smectite mixed-layered structure and finally reaches the muscovite-like structure at 500ºC, which is stable up to 700°C. In all these conditions, these phases retain nitrogen, which is verified by the characteristic spectral bands of ammonium on FTIR analysis. These experiments suggest that in a cold subduction environment [6], such as Valparaiso or Alaska subduction zones, nitrogen could be re-introduced into the mantle.

[1] Lécuyer *et al*., (2000) *EPSL*, **181**, 33-40. [2] Bebout *et al*., (2013) *Elements*, **7**, 333-338. [3] Cartigny & Marty, (2013) *Elements*, **7**, 359-366. [4] Roskosz *et al*., (2013) *Geochim. Cosmochim. Acta*, **121**, 22-30. [5] Li *et al*., (2013), *EPSL*, **377-378**, 311-323. [6] Maruyama & Okamoto, (2007) *Gond. Res*., **11**, 148-165.