Carbon and nitrogen speciation in C-O-H-N fluids at 5.5-7.8 GPa

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Carbon and nitrogen speciation has been studied in the C-O-H-N system at 5.5-7.8 GPa, 1100-1500°C and fO_2 from IW-2 to IW+4 log units [1,2]. At fO_2 near IW in the synthesised fluids carbon species, except for C_1-C_4 alkanes and alcohols, occur in negligible amounts. Methaneimine (CH_3N) and NH_3 are inferred to be the main nitrogen species in N-poor and N-rich reduced fluids, respectively. C_{15}-C_{18} alkanes are slightly higher and oxygenated hydrocarbons are more diverse at higher temperatures and H_2O concentrations. At fO_2 above IW+0.7 log units and T≥1400°C, N_2 became the predominant nitrogen species. At fO_2 of IW+2.5 log units the fluids almost lack methane and contain about 1 rel.% C_2-C_4 alkanes, as well as fractions of percent of C_{15}-C_{18} alkanes and notable contents of alcohols and carboxylic acids. Therefore, the behaviour of CH_3N and NH_3 may control the nitrogen cycle in reduced N-poor peridotitic and N-rich eclogitic mantle. The appearance of the Cl^- ion in the fluid may be coupled to NH_4^+ forming a stable ligand [3]. Since, the pH values of the eclogitic fluids are strongly alkaline, they may contain ionic C-bearing species as well [4].

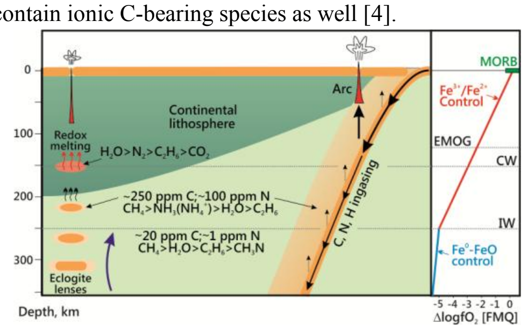

Figure 1: Schematic of the upper mantle volatile cycle.

Oxidation of fluids strongly reduces the concentration of CH_4 and bulk carbon. However, higher alkanes, oxygeneted hydrocarbons can resist oxidation and should remain stable in oxidised mantle. *Study supported by RSF grant 16-17-10041.*

[1] Sokol et al. (2017) *EPSL* **460**, 234-243. [2] Sokol et al. (2017) *Sci. Reports* doi:10.1038/s41598-017-00679-7. [3] Mikhail & Sverjensky (2014) *Nat. Geosci.* **7**, 816-819. [4] Sverjensky et al. (2014) *Nat. Geosci.* **7**, 909-913.