Nitrogen speciation in mantle fluids

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Nitrogen speciation in N-H-O fluids at mantle conditions was studied by means of synthetic fluid inclusions trapped in HF etched quartz and pre-cracked San Carlos olivine. Experiments were performed at 600 - 1300 °C and 15 - 30 kbar using a piston cylinder apparatus, starting with a ~11 mol/L NH_3 solution. A modified double capsule technique was used to attain redox states of various oxygen buffers (Fe-FeO, Co-CoO, Ni-NiO). The recovered fluid inclusions were studied by Raman spectroscopy. The results show that NH_3 and N_2 are the two major nitrogen-bearing species, which stabilities strongly depend on the temperature, pressure, and oxygen fugacity. At conditions relevant to subduction zones, nitrogen occurs mainly as NH_3 and thus behaves similar to the lithophile element K; whereas in the overlying asthenospheric mantle it partially decomposes into N_2 and H_2. The ascent of the mantle fluids into the shallow crust results in complete transform of NH_3 into N_2. In the deep mantle along the geothermal profile, where oxygen fugacity is reduced and pressure is decreased, we expect nitrogen to be present significantly as NH_3 in the fluids, thus there could be much more nitrogen present in the bulk silicate Earth than the value estimated based on N/noble gas ratios in MORB [1].

[1] Marty, B. (1995) *Nature* **377**, 326–329.

Ecological stoichiometry of plant nutrients: A case study of degraded grassland in western Jilin Province, NE China

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Plant growth should be expected to be limited by nitrogen (N) and phosphorus (P) availability in most terrestrial ecosystems. The previous studies indicate that the N/P ratios be usually used to indicate N or P limitation on plant growth. However, how does N/P ratio influence vegetation composition and species richness? It has been one of the hotly discussed issues in the ecological stoichiometry. However, the N and P stoichiometry in the leaves of different plants from the Jiangjiadian grassland in Da'an city in western Jilin Province, NE China, provides insights for the above issue. The results indicate that N and P stoichiometry in the leaves of *Leymus chinensis, Phragmites australis, Chloris virgata, Puccinellia distans, Suaeda glauca* from the grassland are 1.09-3.4%, 0.68-2.94%, 1.69-2.76%, 1.47-2.35% and 1.88-8.7% for N and 0.056-0.254%, 0.082-0.184%, 0.105-0.122%, 0.057-0.107% and 0.067-0.072% for P, respectively. Their corresponding N/P ratios are 9.06-23.53, 8.31-18.12, 16.11-22.64, 22.02-25.88 and 28-28.06 respectively. The arithmetic means for the five species are 1.96%, 1.75%, 2.23%, 1.91% and 5.29 % for N, 0.119%, 0.120%, 0.113%, 0.082% and 0.069% for P, and 17.7, 13.83, 19.38, 23.95 and 28.03 for N/P ratios, respectively. The N and P contents as well as N/P ratios are high in the early stage of plant growth owing to small biomass, and then greatly decrease with leaf expansion during their fast growth period. With the increase of degree of grassland degradation, the *Leymus chinense, Phragmites australis, Chloris virgata, Puccinellia tenuiflora,* and *Suaeda glauca* subsequently appear. Taken together, it is suggested that the N and P contents as well as N/P ratios in plants differ greatly at different degredation stages because of the difference of components of the plant communities at the different degraded stages. Therefore, we conclude that stoichiometry ratios (N/P) in dominant plant species can serve as indicators of direction of plant succession in the degraded grassland.