Evolving habitable conditions

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The discovery of several super-Earths has opened the opportunity for comparative planetology with the solid planets in the solar system. A central question is that of habitability on super-Earths, and a natural starting point is our knowledge of Earth and the Terrestrial Planets. A planet becomes habitable depending on its evolution, from its early dynamics within the solar nebula, which determine its composition and distance from the star, to its physicochemical evolution after formation. At present, the terrestrial planets exhibit different tectonic regimes that affect surface conditions and atmospheric composition, which in turn affect the potential for life. There is a current debate on the likelihood of plate tectonics on super-Earths with two groups having reached opposite conclusions. I will discuss the different approaches, and offer some answers to explain the apparent discrepancy. In addition, establishing the timescale for the onset of plate tectonics might require determining the conditions the first lithosphere is subjected to following the solidification of the magma ocean. I will present results on the similarities and differences of this early stage between planets of different masses.

Determination of nitrogen functionalities by X-ray photoelectron spectroscopy (XPS) in FBC chars

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This abstract reports the study of the nitrogen (N) functionalities in chars resulting from a set of seven coals of growing rank (0.41-1.41 $\%R_r$), a semi-anthracite (1.96 $\%R_r$) and an anthracite (4.98 $\%R_r$). All feeds are vitrinite rich (79-94 vol.%, m.m.f.) from the PennState Coal Bank and were devolatilized in a fluidised bed reactor at 850°C, (10^4 K/s; $6\%O_2$; 500–1000 μm). N-functionalities were determined using a VG Scientific ESCALAB 200A, and the spectra deconvolution followed Kelemen *et al.* [1].

After coal devolatilization a peak of oxidized-N at 403.0 N(1s) eV was observed in all coal chars (Fig. 1).

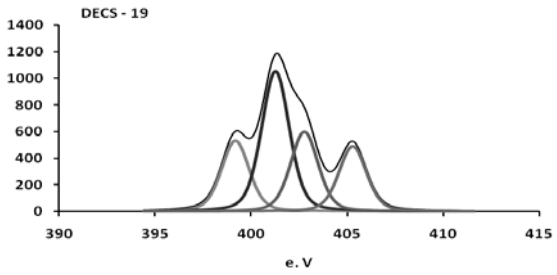

Figure 1: Representative XPS spectra of nitrogen (1s) obtained on fluidized bed (850°C) coal char.

Relatively to coal, pyridinic-N [398.8 N(1s) eV] increased in two of the coal chars (2% and 9%), and decreased in the remaining five (2% to 18%). In all coal chars pyrrolic-N [400.2 N(1s) eV] decreased (5% to 33%). Quaternary-N [401.4 N(1s) eV] increased between 2% and 18% in all coal chars, except for char of the coal with 0.78 R_r that decreased 2%.

The semi-anthracite and the anthracite presented oxidized-N peak, due to storage oxidation, and no significative changes were found in any nitrogen functionality in their chars.

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[1] Kelemen *et al*. (1995). *Energeia* **6**, 1-4.