EGU 2020: Sharing Geoscience Online

Role of grain boundary diffusion in H-D exchange in mantle xenoliths

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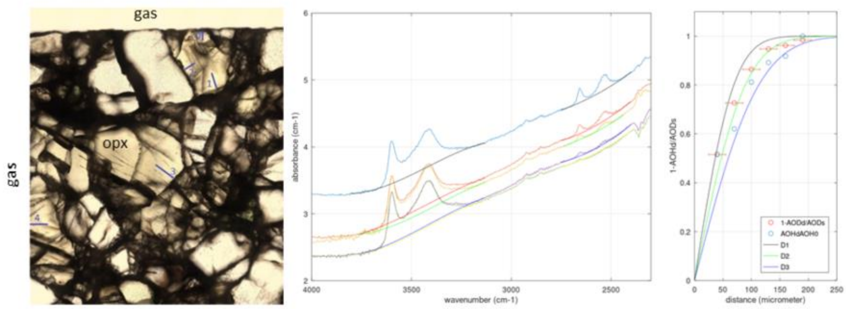
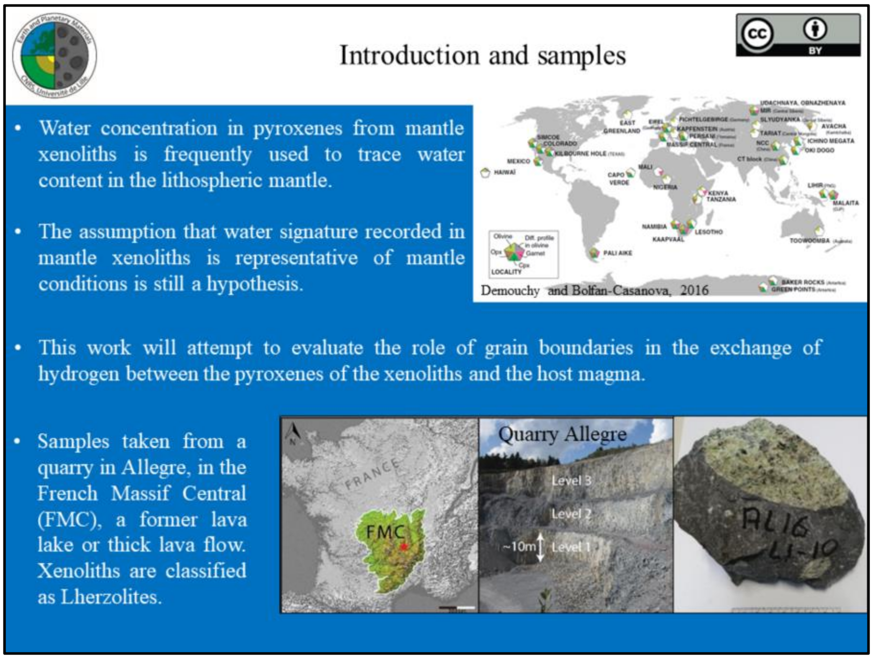
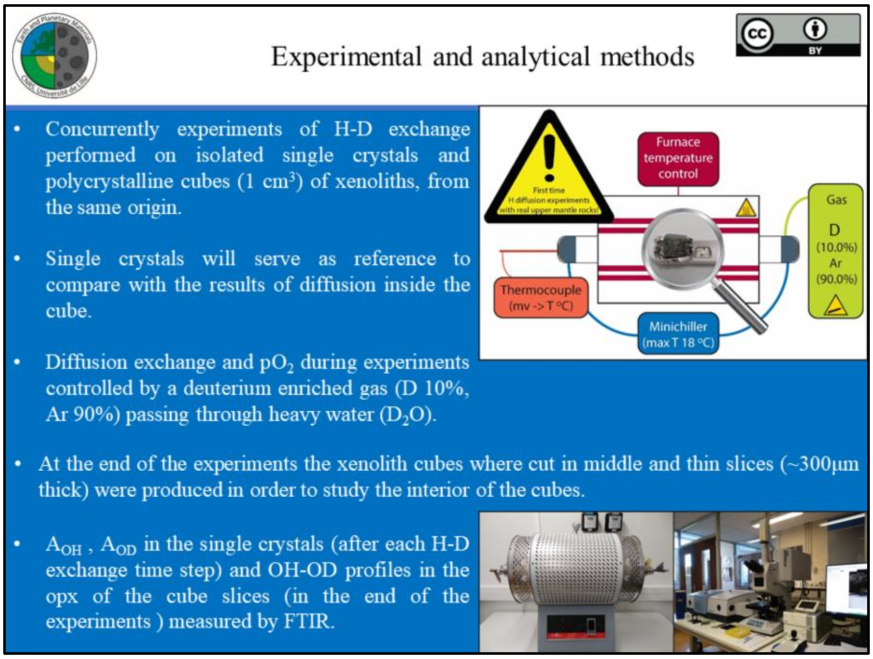


This work is part of the PhD project: Do mantle xenoliths preserve water signature from the lithospheric mantle and how? An experimental and numerical approach.

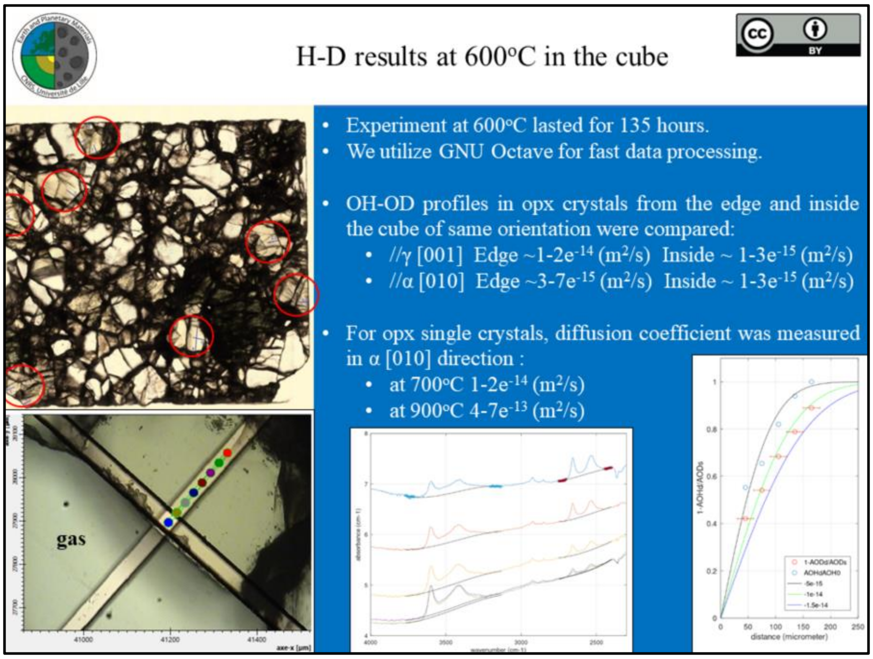
Hello there! I am Konstantinos and together with my supervisor we would like to briefly present you our work on the affect of the grain boundary diffusion in mantle xenoliths. Okay, lets start!



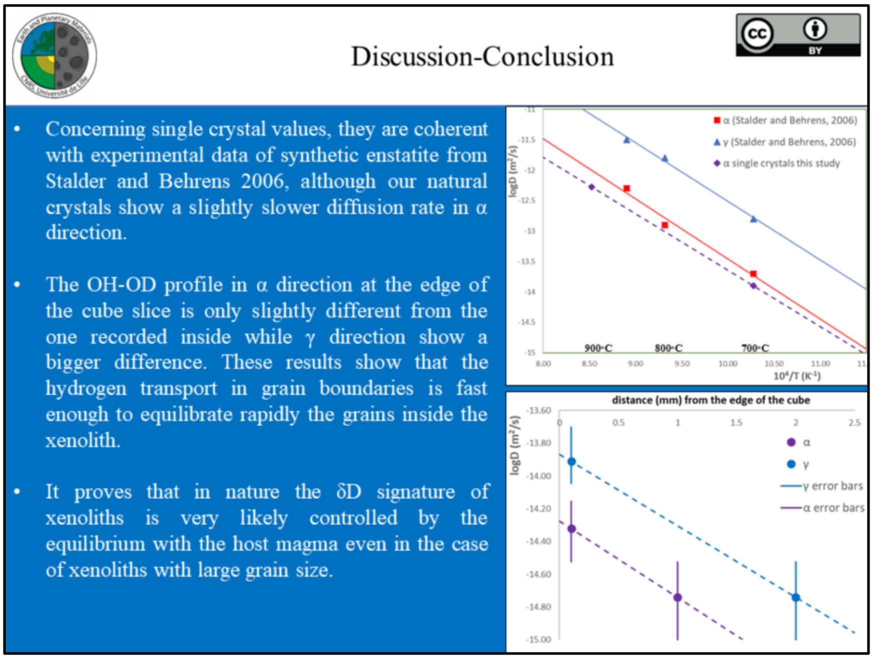
[bullet 1 - slide text] In the map presented you can see a fraction of the geological localities of studies which are reporting hydrogen concentrations in mantle minerals. But we do not understand yet how these pyroxenes can preserve a memory of their deep equilibrium prior of their transport to the surface, so **[bullet 2 - slide text].** **[bullet 3 - slide text]** through experiments of hydrogen exchange in blocks of mantle xenoliths. As the isotopic exchange is the fastest process, this is just the first step of the experiments and it will followed by experiments at higher temperatures involving reaction of oxidation-reduction of iron and formation/destruction of cation vacancies. **[bullet 4 – slide text].** The xenoliths contain clinopyroxene, orthopyroxene and olivine of mm to sub-mm size.



[bullet 1 - slide text] [bullet 2 - slide text] In the figure we can see a schematic set-up of the experiment and apparatus. The samples (xenolith cube, Cpx and Opx crystal) are placed in alumina cases and then in a ceramic holder. The ceramic holder then placed inside the ceramic tube, where the thermocouple is also present in order to accurately measure the temperature. **[bullet 3 - slide text] [bullet 4 - slide text] [bullet 5 - slide text]** In the picture we can see the high-temperature furnace that is designed specially with sufficient diameter to perform experiments in multiple xenolith cubes at a time and next the Bruker's Hyperion 3000 FTIR microscope, coupled to the Vertex 70 spectrometer at LASIR lab, Lille University, where the FTIR analyses performed.



We present here the results of H-D exchange experiment performed at 600ºC at room pressure. **[bullet 1 - slide text]** In the figure on the top left we can see how the cube slice looks like (1 cm^2). Red circles are opx in the edge and inside the cube that were measured. **[bullet 2 - slide text]** More specific we developed a code in GNU Octave software were we could load our spectra files (txt) and then normalize data to cm, plot, calculate the polynomial backgrounds, find absorbance for OH and OD, and finally calculate the diffusion coefficient of the profile based on Fick's second law. At bottom left we see a representative profile in a crystal at the edge of the cube, at the center the graph show the profile spectra and the OH-OD absorbance and on the right the calculated diffusion coefficient for a profile. Distance in the last graph refers to the distance from the rim of the crystal. **[bullet 3 - slide text] [bullet 4 - slide text]**



[bullet 1 - slide text], something we can observe in the top figure. **[bullet 2 - slide text]** In the bottom figure we plot the diffusion coefficients of profiles in regard their position from the edge of the cube. **[bullet 3 - slide text]** Unfortunately our latest experiments at higher temperatures with xenolith cubes where postponed due to the virus outbreak.

Thank you again! Stay healthy! Cheers!