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Fluorine and Chlorine in the transition Zone

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We report concentrations of Fluorine (F) and Chlorine (Cl) in synthetic wadsleyite (Wd) and ringwoodite (Rw). Synthesis were performed under pressures (14–22GPa) and temperatures (1100–1400°C) relevant to the transition zone (TZ: 410–670 km depth) using multi-anvil press experiments in MLV Clermont-Ferrand, France and in BGI Bayreuth, Germany. F, Cl and H contents were measured using Particle Induced Gamma-Ray Emission (PIGE), Particle Induced X-ray Emission (PIXE) and Elastic Recoil Detection Analysis (ERDA) respectively, using a nuclear microprobe at CEA Saclay. Results show that F (up to 850 ppm wt.) and Cl (up to 200 ppm wt.) are concentrated together with H2O in both Wd and Rw (Roberge et al., 2015; 2017). Cl content in Rw and Wd is significantly higher than in other nominally anhydrous minerals of the upper mantle (olivine, pyroxene, garnet), when we found that F is also concentrated in hydrous olivine (up to 1700 ppm wt., Crepisson et al, 2014). With these data we put constraints on the F and Cl budget of the deep Earth, we propose that the TZ may be a major repository for major halogen elements in the mantle. We also show that both F and Cl abundances are underestimated for the bulk silicate Earth (BSE). We propose maximum abundances for the BSE of 59 ppm wt. F and 37 ppm wt. Cl, these abundances are higher than the values proposed by McDonougth and Sun in 1995, of 25 and 17 ppm wt. respectively. New results on F-bearing ringwoodite will be presented at the meeting.

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