

## Fluorine and Chlorine in the transition Zone

Hélène Bureau, Mathilde Roberge, Nathalie Casanova, Geeth Manthilake,  
Suzy Surble, Sarah Figowy, Guillaume Fiquet

► **To cite this version:**

Hélène Bureau, Mathilde Roberge, Nathalie Casanova, Geeth Manthilake, Suzy Surble, et al.. Fluorine and Chlorine in the transition Zone. 9th High Pressure Mineral Physics Seminar, Sep 2017, St Malo, France. cea-02341734

**HAL Id: cea-02341734**

**<https://hal-cea.archives-ouvertes.fr/cea-02341734>**

Submitted on 31 Oct 2019

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

# Fluorine and Chlorine in the transition Zone

Helene Bureau <sup>\*† 1</sup>, Mathilde Roberge <sup>1</sup>, Nathalie Bolfan Casanova <sup>2</sup>,  
Geeth Manthilake <sup>2</sup>, Suzy Surblé <sup>3</sup>, Sarah Figowy <sup>1</sup>, Guillaume Fiquet <sup>1</sup>

<sup>1</sup> Institut de minéralogie, de physique des matériaux et de cosmochimie (IMPMC) – Museum National d’Histoire Naturelle, Université Pierre et Marie Curie - Paris 6 : UMR120, Institut de recherche pour le développement [IRD] : UR206, Centre National de la Recherche Scientifique : UMR7590 – Tour 23 - Barre 22-23 - 4e étage - BC 115 4 place Jussieu 75252 PARIS, France

<sup>2</sup> Laboratoire Magmas et Volcans (LMV) – Université Jean Monnet [Saint-Etienne], Institut de Recherche pour le Développement et la société : UMR163, Université Clermont Auvergne, Centre National de la Recherche Scientifique : UMR6524 – Campus Universitaire des Cézeaux, 6 Avenue Blaise Pascal, 63178 Aubière Cedex, France

<sup>3</sup> CEA Saclay (CEA) – CEA-DRF-IRAMIS – LEEL, NIMBE, CEA, CNRS, Université Paris-Saclay, CEA Saclay, 91191 Gif-sur-Yvette Cedex, France, France

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 H<sub>2</sub>O 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., Creppisson 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 McDonough and Sun in 1995, of 25 and 17 ppm wt. respectively. New results on F-bearing ringwoodite will be presented at the meeting.

Creppisson et al., 2014. Clumped fluoride-hydroxyl defects in forsterite: implications for the upper-mantle, *EPSL* 390, 287-295.

McDonough, W.F., Sun, S., 1995. The composition of the Earth. *Chem. Geol.*120, 223–253.

Roberge et al., 2015. Is the transition zone a deep reservoir for fluorine?, *EPSL*, 429, 25-32.

Roberge et al., 2017. Chlorine in wadsleyite and ringwoodite: an experimental study, *EPSL* 467, 99-107.

---

\*Speaker

†Corresponding author: helene.bureau@impmc.upmc.fr