



**HAL**  
open science

## SEM and $\mu$ -Raman characterization of electron beam damages on fluor-apatites: Implication for EPMA analysis.

Guillaume Wille, Ida Di Carlo, Abdeltif Lahfid

► **To cite this version:**

Guillaume Wille, Ida Di Carlo, Abdeltif Lahfid. SEM and  $\mu$ -Raman characterization of electron beam damages on fluor-apatites: Implication for EPMA analysis.. EMAS 2014: 11th EMAS Regional Workshop on ELECTRON PROBE MICROANALYSIS OF MATERIALS TODAY - PRACTICAL ASPECTS, Sep 2014, Leoben, Austria. hal-01011944

**HAL Id: hal-01011944**

**<https://brgm.hal.science/hal-01011944v1>**

Submitted on 25 Jun 2014

**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.

## SEM AND $\mu$ -RAMAN CHARACTERIZATION OF ELECTRON BEAM DAMAGES ON FLUOR-APATITES - IMPLICATION FOR EPMA ANALYSIS

G. Wille<sup>a,c</sup>, I. Di Carlo<sup>b,c</sup>, A. Lahfid<sup>a,c</sup>

<sup>a</sup>BRGM, 3 avenue Claude Guillemin, P.O. Box 6009, FR-45060 Orléans Cedex 2, France

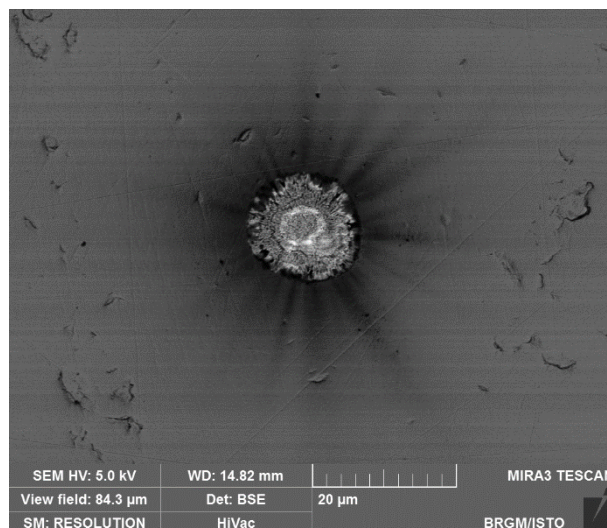
Université d'Orléans – CNRS/UMR7327 – INSU , 1A Rue de la Férollerie, 45100 Orléans, France

<sup>c</sup> UMR CNRS, Université d'Orléans, BRGM

Apatites are phosphate minerals of a general formula  $\text{Ca}_5(\text{PO}_4)_3(\text{OH},\text{Cl},\text{F})$ . They are the principal constituent of teeth and bone (natural and synthetic); represent an important accessory mineral in volcanic geological environment by means of a storage of elements such as halogens, sulphates, carbonates, Sr and REE; represent a packaging of radionuclides for nuclear waste, trapping heavy metals and finally are mostly used fertilizers.

This work is focused on fluorapatite, the Fluorine-rich composition. As mentioned by several authors, SEM and EPMA analysis of F-apatites is complicated by the strong consequences of electron beam damages. This problem is particularly strong for the determination of fluorine concentration. Indeed a complex intensity variation is observed for the fluorine signal collected by the spectrometer; this variation mainly depends on two parameters: crystal orientation of the mineral grain and electron beam setup.

Crystallographically-oriented Fluor-apatite were irradiated under the EPMA electron beam, using different setup (i.e. acceleration voltage, beam current, beam size) following the F, Ca and PWDS-variations signal. Beam damages were characterized by SEM and  $\mu$ -Raman (including Raman-in-SEM).



SEM image of the damage caused by irradiation of a F-apatite with the electron beam oriented  $\parallel$  to the crystallographic c-axis.