

The fate of iodine-129 released from the Fukushima-Daiichi nuclear accident

MATT N. HEROD^{1*}, MARTIN SUCHY², IAN D. CLARK¹,
W.E. KIESER³ AND GWYN GRAHAM²

¹University of Ottawa, Department of Earth Sciences, Ottawa, ON, Canada, (mhero065@uottawa.ca)

²Environment Canada, Vancouver, BC, Canada

³University of Ottawa, Department of Physics, Ottawa, ON, Canada

The Fukushima-Daiichi nuclear accident (FDNA) released large amounts of fission product radionuclides into the environment in the spring and summer of 2011. Along with short lived fission products, iodine-129 (15.7 million year half-life) was also released. ¹²⁹I is recognized as a useful tracer due to its mobile geochemical behaviour. To test if ¹²⁹I released by the FDNA was reaching Canada, rain samples were collected in Vancouver from March 2011 to March 2012. Archived precipitation samples from Environment Canada's station on Saturna Island and from the National Atmospheric Deposition Program in northern Washington State were also measured to establish a pre-accident ¹²⁹I background. Groundwater from the Abbotsford-Sumas Aquifer was sampled to determine the fate of ¹²⁹I. The mean pre-accident background for ¹²⁹I in rain is 38.15×10^6 atoms/L (n=4). Immediately following the FDNA, ¹²⁹I values increased sharply to 227.2×10^6 atoms/L and quickly returned to near-background levels. However, pulses of elevated ¹²⁹I continued for several months. The ¹²⁹I in shallow (³H/³He age <1.4 yrs) [1] groundwater were unchanged through November 2012 with an average of 11.39×10^6 atoms/L (n=21). The 6-fold increase in ¹²⁹I concentrations from both Vancouver and Saturna Island are coincident, and occur directly after the initial release from the FDNA. This indicates atmospheric transport and deposition of ¹²⁹I and agrees well with the timing of elevated ¹³¹I and ¹³⁷Cs measurements in the United States [2]. The lack of groundwater response suggests that ¹²⁹I is possibly attenuated in soil, which is consistent with its geochemical behaviour.

[1] Wassenaar *et al* (2006) *Environ. Sci. Tech.***40**, 4626-4632.

[2] Wetherbee *et al* (2012) *Environ. Sci. Tech.***46**, 2574-2582

Spectroscopy and magnetic imaging at the nanoscale for the study of magnetic minerals

JULIA HERRERO-ALBILLOS^{1,2,3}

¹ARAID researcher at Centro Universitario de la Defensa. Ctra. de Huesca s/n. 50090 Zaragoza, SPAIN

²ICMA (Universidad de Zaragoza - CSIC). Facultad de Ciencias 50009 Zaragoza, SPAIN

³Julia.Herrero@unizar.es

X-ray magnetic circular dichroism (XMCD) is the preferential absorption of X-rays by a magnetic sample for left and right circular polarized light. XMCD is produced at the resonance absorption energies of the different atoms, and therefore provides element-specific magnetic information. Since its discovery in 1987 by Schütz, XMCD has been pivotal in the understanding of magnetic materials and it is nowadays routinely used in both basic and applied research in magnetism. X-rays with variable polarization at a wide range of energies are readily produced in nearly 50 synchrotron radiation facilities around the world, offering varied sample environments (temperatures, pressure, magnetic fields, etc.) and XMCD-related techniques.

One of the most exciting of those techniques is X-ray Photo-Emission Electron Microscopy (XPEEM). Using XMCD as a contrast mechanism, in combination with a spatial resolution down to 30 nm, element-specific spatially resolved magnetization maps can be obtained. Moreover, recent developments in dedicated instruments, allowing performing experiments at low temperatures (40 to 600 K), under applied magnetic fields (up to about 100 mT) and with electrical contacts, as well as time resolved experiments (in the nanosecond range) to study magnetization dynamics.

In this talk I will present the capabilities of those two techniques in the study of the fundamental properties of natural magnetic rocks and how a deep understanding of their nanostructure can shed light onto their macroscopic magnetic properties.

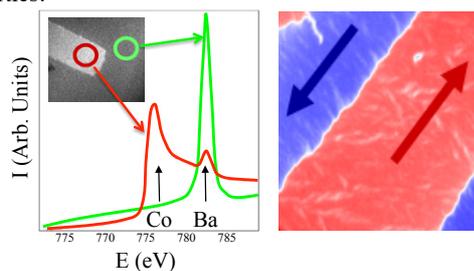


Figure 1. Capabilities of XPEEM: Chemical map and related spectra where the distribution of Co and Ba on a sample is observed (left). Magnetization map on a Fe film, with two magnetic domains (right).