ID: Type: **Poster**

Gas-Magma Interactions in Nuclear Cavities and Their Effects on the Xenon Isotope Ratios

Underground nuclear explosions lead to the formation of cavities partly filled with magma contributed by the surrounding rocks during cooling, where nuclear reactions take place under the form of multiparent-multidaughter decay chains with half-lives covering many orders of magnitude. In the framework of the International Monitoring System, xenon isotopes decayed from their parent iodine, particularly in the 131, 133 and 135 chains, are central for the discrimination of underground nuclear explosions based on the ratios of four xenon isotopes. However, as a function of time and distance following an underground nuclear explosion, the isotope ratios of xenon vary depending on when and where the fission products are fractionated. Because xenon and their parent iodine isotopes have contrasted solubility and diffusion capabilities in magmas, we consider here a new model for fractionation of iodine and xenon isotopes. For each of the 131, 133 and 135 chains, trapping of cavity gaseous iodine and xenon into the magma as well as their back-diffusion from the magma toward the cavity gas phase are incorporated into modified radioactive decay and ingrowth equations. The consequences on the xenon isotope ratios are computed and compared to scenarios where these effects are neglected.

Primary author: PILI, Eric (Commissariat à l'énergie atomique et aux énergies alternatives (CEA))

Presenter: PILI, Eric (Commissariat à l'énergie atomique et aux énergies alternatives (CEA))

Track Classification: 1. The Earth as a complex system