Anomalously low $^3He/^4He$ ratios in lavas from the Great Dodo Plain on the Central Indian Ridge axis

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We have undertaken noble gas isotope analyses for lavas from on and off the Central Indian Ridge (CIR) axis of segments between 15 to 18. These samples were collected during the KH-06-4 Research Cruise by R/V Hakuho-Maru [1]. The sampling areas include the large on-axis lava plain made up with thick sheet flows known as 'The Great Dodo Lava Rift Valley' and some newly found nearby seamounts off-axis towards the Rodriguez Ridge. These samples are previously not studied for noble gases; thus are expected to provide new constraints especially on a recent debate over the modes of geochemical interaction between a spreading CIR and a hotspot presently located at Réunion Island, ~1100 km to the west of the ridge.

Noble gas analyses were carried out by using a VG5400 noble gas mass spectrometer of Okayama University. On axis lava from the segment 18, the north of Marie-Celeste Fracture Zone (MFZ), and several off axis lava from the segment 16 yielded typical N-MORB-like helium and argon isotope signatures with very uniform $^3He/^4He$ ratios of 8.4±0.1 Ra (Ra = $^3He/^4He$ of air) and $^{4\circ}Ar/^{36}Ar$ ratios of up to 4000. In contrast, on-axis samples from The Dodo lava plain yielded systematically lower $^3He/^4He$ ratios of 6.5 to 7 Ra with a very low $^{4\circ}Ar/^{36}Ar$ of up to 370. Apparently, there are no indication of the helium contribution from a high $^3He/^4He$ component associated with the Réunion hotspot with its magmas typically showing >12.5Ra. Among the previously reported helium data in samples between Réunion and the CIR, similarly low $^3He/^4He$ ratios were found in the Intermediate and Younger Series of Mauritious lavas [2]. Thus, if these low $^3He/^4He$ ratios in on-axis lava from the Dodo Plain is associated with the asthenospheric flow derived from the hotspot, its source need to be similar to that feeds relatively recent Mauritious magma, but an additional explanation must be given for the occurrence of N-MORB like helium off the axis to the west from the Dodo lava plain.

[1] Orihashi *et al*. (2009) *GCA* **73**(13) Sup. **1**, A975.
[2] Hanyu *et al*. (2001) *Earth Planet. Sci. Lett*. **193**, 83–98.

Zn isotopes as tracers of metal atmospheric deposition and soil contamination at the vicinity of an old mining and refining complex (Portugal)

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As recently demonstrated, Zn and Cd can evaporate from ore during pyrometallurgical processes (smelting), which favour escape of light isotopes in the exhaust and retention of heavy isotopes in the slag residues. Based on those observations, the aim of our present multi-isotope study (Zn, Cd and Pb) is to trace metal atmospheric pollution and soil contamination in an inhabited valley encountered an old Cu-pyrite mine and smelting-refining complex. S. Domingos Mine (SDM) in Alentejo (southern Portugal) is abandoned since 1966. About 5Mt of waste deposits form large heaps and are frequently used for constructions (roads, playgrounds,...). Inhabitants occupy soils containing up to 1.5wt% in Pb, 800 mg. kg^{-1} in Zn and 10 mg. kg^{-1} in Cd. Samples of unprocessed ores, tailings, cultivated and village soils were analyzed for Zn isotopic compositions (2SD on $\delta^{66}Zn$ from 0.02 to 0.06) on a Nu-Plasma MC-ICP-MS (ULB). Unprocessed pyrites show uniform $\delta^{66}Zn$ values (+0.07 to +0.1‰). In contrast, tailings and soils show strong Zn isotopic fractionation, with the highest $\delta^{66}Zn$ values (+0.53 to +0.61‰) in tailings close an abandoned sulphur refining factory and the lowest values (-0.69 to -0.18‰) in village soils, located 1.5 km North East from the sulphur factory. Those soils may have recorded deposition of particles emitted by the factory chimney. Analyses of Pb and Cd isotopic compositions are in progress [1], as well as studies of lichens and dry deposition plates, which will help to discriminate relative contributions in soils of the current atmospheric deposition and the old waste deposits.

[1] Africano *et al*. (2010) *GCA*, this volume.