

Discrepancy between terrestrial Xenology and He-Ne systematics

R. YOKOCHI AND B. MARTY

CRPG, BP20, 54501 Vandoeuvre lès Nancy,

Some of xenon isotopes have been produced by extinct radioactivities ($^{129}\text{I} - ^{129}\text{Xe}$, $\tau_{1/2} = 15.7 \text{ My}$; $^{244}\text{Pu} - ^{131-136}\text{Xe}$, $\tau_{1/2} = 82 \text{ My}$) as well as by the spontaneous fission of U isotopes, which makes this element particularly important for understanding differentiation processes of Earth on contrasted timescales in addition to fission products from $^{235,238}\text{U}$ to serve as an excellent chronometer on the early differentiation of the earth (e.g. Ozima et al., 1985; Marty, 1989; Kunz et al., 1998). MORBs display clear excesses in ^{129}Xe (^{129}I relict) and ^{136}Xe (from both U and Pu fissions) relative to atmosphere indicating the contribution of these in-situ produced isotopes after the formation of atmosphere, and define a correlation between $^{129}\text{Xe}/^{130}\text{Xe}$ (^{130}Xe is not produced by radioactivity) and $^{136}\text{Xe}/^{130}\text{Xe}$, which slope is a function of $^{129}\text{I}/(^{244}\text{Pu} + ^{238}\text{U})$ ratio, thus a function of the timing of MORB mantle fractionation. He-Ne isotopes of MORB- and plume-related samples indicate that the former reservoir is richer in radiogenic isotopes relative to primordial isotopes and we want to test if a similar situation arises in the case of xenon isotopes been established to reveal the difference between two reservoirs due to different degree of radiogenic contribution. Since plume component suffered less radiogenic component according to He-Ne isotopes, similar observation should be expected on xenon while it is not clear due to atmospheric contamination.

Here we report a finding of ^{129}Xe excesses accompanied by high $^3\text{He}/^4\text{He}$ signature ratios and plume-type Ne isotopes characteristic in samples from of the Kola alkaline-ultramafic-carbonatite complex. As was the case for Icelandic glasses and Loihi dunite samples (Trieloff, 2000), ^{129}Xe excesses observed the excesses was are small (up to 2 %), and non radiogenic isotope ratios being are undistinguishable from air. If non-atmospheric xenon (e.g., planetary or solar) was present in the mantle, it is nowadays dominated by air-like xenon most likely of recycled origin. $^{129}\text{Xe}/^{130}\text{Xe}$ - $^{136}\text{Xe}/^{130}\text{Xe}$ ratios correlate and define a slope (3.30 ± 0.27) which is indistinguishable from that of MORBs (3.29 ± 0.12 ; Moreira et al., 1998) in contrast to the case of He-Ne systematics. Several hypotheses may be possible to explain this discrepancy. First possibility is (i) the xenon isotope composition of the "less degassed" plume source is atmospheric due to subduction, and the excess observed is *all* due to the *contamination* of MORB-like xenon. (ii) Alternatively, (ii) the I/(Pu+U) ratio was the same in all sampled mantle domains. In this case, , and the best way to explain the extreme similarity of slopes mentioned above is to consider that ^{136}Xe is mostly from ^{244}Pu and that mantle fractionation took place early and was global. These hypotheses and few others will also be discussed.

References: Kunz et al. (1998) *Science* 280, 877-880; Marty, B. (1989) *Earth Plan. Sci. Lett.* 94, 45-56; Moreira et al. (1998) *Science* 279, 1178-1181; Ozima et al. (1985) *Nature* 315, 471-474; Trieloff et al. (2000) *Science* 288, 1036-1038.

Sr isotopic study of the soil-vegetation system in tropical rainforest

Y. YOKOO¹ AND K. KITAYAMA²

¹Tokyo University of Agriculture and Technology, Tokyo, Japan (yokoo-y@cc.tuat.ac.jp)

²Center for Ecological Research, Kyoto University, Otsu, Japan (kitayama@ecology.kyoto-u.ac.jp)

Introduction

Strontium isotopes have been used in recent years as tracers to improve our understanding of the circulation of elements in the soil-vegetation system. We report here the $^{87}\text{Sr}/^{86}\text{Sr}$ ratios and elemental compositions of plants and soils of tropical rainforests on two types of bedrocks.

Samples and Experiments

Soil and grass plant samples were collected at two sites on sedimentary rock and at three sites on ultrabasic rock on Mount Kinabalu, Borneo. We collected soil from the A horizon Five grams of the air-dried soil was reacted with 50 ml of 1N $\text{CH}_3\text{COONH}_4$ to collect exchangeable cations. After one hour, the soil was centrifuged and the extracted solution was used for the analysis. About 100 mg of the bulk soil and plant was dissolved with $\text{HNO}_3\text{-HClO}_4\text{-HF}$ in a Teflon vessel at 100°C for 12 hours and the dried. The Sr isotopic composition was determined using a Finnigan MAT 262RPQ mass spectrometer at the Institute of Geoscience in the University of Tsukuba. The cation concentrations were determined using ICP-AES (ICP-757V, Nippon Jarrell-Ash) at Chemical Analysis Center, University of Tsukuba.

Results and Discussion

The $\text{CH}_3\text{COONH}_4$ - extracted solution of soil had the same $^{87}\text{Sr}/^{86}\text{Sr}$ ratio as the associated plant, demonstrating an extensive exchange of Sr and other cations between the soil exchangeable pool cations and vegetation. In contrast, the $^{87}\text{Sr}/^{86}\text{Sr}$ ratios of bulk soil were different from those of the exchangeable soil components, indicating that Sr in soil minerals were irrelevant to the circulation of materials between the plant and soil-solution. The same results were reported by Nakano, et al. (2001) and Yokoo and Nakano (2001), who performed same experiment to the sample collected in the different geological and climatic setting. The $\text{CH}_3\text{COONH}_4$ extracted solutions plotted in a distinct region on the ternary Fe-Mg-Ca and Mg-Ca-Sr diagrams and they were close to the plants in the area. In contrast, the cation compositions of bulk soil differed from those of the exchangeable soil fractions and they reflected the elemental composition of bedrock and pedogenesis process.

References

- Nakano T., Yokoo Y., Yamanaka M., (2001), *Hydrological Processes*, **15**, 1859-1875.
Yokoo Y. and Nakano T., (2001), *Water, Air, Soil Pollut.* **130**, 1583-1588.