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## Radon and carbon dioxide in northern Vietnamese limestone caves

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Concentrations of radon and carbon dioxide were measured in the air of three limestone caves in the Dong Van Karst Plateau in northern Vietnam in May 2015 via  $\alpha$ -spectroscopy (SARAD<sup>®</sup> RTM 2200, SARAD<sup>®</sup>GmbH, Germany) and FTIR (GasmeterDX-4030, Gasmeter Technologies Oy, Finland), respectively. Rong Cave holds a local freshwater reservoir and featured 930 Bqm<sup>-3</sup> of  $\alpha$ -radiation from radon near the cave's entrance and up to 10,853 Bqm<sup>-3</sup> deeper in the cave. Pai Lung Cave seasonally stores water for agriculture and had radon activities from 310 Bqm<sup>-3</sup> near the entrance to 5271 Bqm<sup>-3</sup> in the interior. The touristically developed section of Na Luong Cave reached 1240 Bqm<sup>-3</sup>. Radon abundances were roughly proportional to carbon dioxide concentrations in air in the three caves at 534-1437 ppm, 497-1060 ppm and 509-735 ppm, respectively. The small 'warm season' thermal gradient in May between cave air (25-31°C) and outside air (25-37°C) limited convective air exchange. Carbon dioxide is likely the carrier gas transporting radon from deeper geological strata (possibly shales) along sub-vertical faults into subterranean karst voids. The observed radon levels in the three caves are considerably higher than, for example, the United Kingdom's recommended threshold Action Levels in the workplace (400 Bqm<sup>-3</sup>) and for domestic properties (200 Bqm<sup>-3</sup>). Workers in Rong and Pai Lung caves as well as visitors in Na Luong Cave may be exposed to harmful radiation. 'Cold season' complementary measurements are planned for December 2015.

### Biography

Duong Nguyen-Thuy has completed her PhD in Mineralogy-Geochemistry at Vietnam National University and she currently serves as a Lecturer in the Faculty of Geology, VNU University of Science in Ha Noi, Vietnam. She has participated in more than 10 national research projects and published more than 20 peer-reviewed papers in Vietnamese and International journals.

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