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The natural flux of greenhouse gases in the case of monitoring the flux of juvenile carbon dioxide in the Hranice Karst

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Located in the Teplice nad Bečvou district 40 km SE of Olomouc (Czech Republic), the hydrothermal Hranice Karst with the Zbrašov Aragonite Caves has been developed in the sequence of Palaeozoic limestones as a result of deep influx of thermal water charged with subcrustal carbon dioxide (CO_2). This area of discharge of juvenile carbon dioxide is a unique place where one can study the long-term natural production of a greenhouse gas and confront it with the anthropogenic production. As a result, the continuous measurements of the properties of the cave microclimate with additional seasonal measurements of flux of carbon dioxide give rise to a rare pool of data that cover natural routes of greenhouse gases. Repeated seasonal analysis of the ratio of stable carbon isotopes in carbon dioxide ($d^{13}C$ around -5 ‰) (Meyberg – Rinne, 1995)has suggested the juvenile (mantle) origin of this gas. Isotopic analyses in the mineral water of dissolved gases (He) show that some part of these gases come from the upper mantle of the Earth. The lower floors of the caves are filled with carbon dioxide producing so-called gas lakes in the area. Concentrations of the gas commonly reach 40 % by volume. In 1999, for example, the average concentration in the Gallas dome was 84.9 % by volume. Flux of CO_2 ($g.m^{-2}.d^{-1}$) was measured on the surface and in the cave. The homogenisation chamber and the pumping test were applied to evaluate the CO_2 flux. The average CO_2 flux in the soil ranged from 74 to 125 $g.m^{-2}.d^{-1}$, reflecting the venting of subcrustal CO_2 in the Hranice area (Geršl et al., 2012). In the Zbrašov Aragonite Caves the CO_2 concentration in the atmosphere fluctuates from 0,X to 85 % with the measured constant flux being 32 894 $g.m^{-2}.d^{-1}$. Since 2005, the CO_2 concentrations in the cave area have been reported by an automatic monitoring system at 10 cave sites. CO_2 concentrations are recorded in 5-min intervals. Interpretation can be put into the context of measuring concentrations of Rn, groundwater levels, and influence of the ambient conditions on the cave system and the operation of the visitor trail. The data obtained are an exceptional source of information about the behaviour of natural emissions of a greenhouse gas in the form of juvenile carbon dioxide. The hydrothermal speleothems carry unique information about production of carbon dioxide in the studied area. Based on their dating using the $^{230}Th/^{234}U$ method it can be deduced indirectly that the carbon dioxide emissions occurred as early as 84-127 thousand years ago in the area.

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Geršl, M. – Geršlová, E. – Šimečková, B. (2012): Subcrustal CO_2 flux measurement in the Hranice hydrothermal Karst, methodology and first results. – Geoscience research reports for 2011, 45, D, 162-166. Praha.

Meyberg, M. – Rinne, B. (1995): Messung des $^3He/^4He$-Isotopenverhältnisses im Hranicka Propast (Tschechische Republik). – Die Höhle. Zeitschrift für Karst- und Höhlenkunde, 46, 1, 5-8. Wien.