

## **CO<sub>2</sub> radiocarbon measurements in South-France caves Interest for the carbon origin and for cave air and hydrology dynamics**

*D. Genty<sup>1</sup>, M. Massault<sup>2</sup>, Marc Delmotte<sup>1</sup>, François Bourges<sup>3</sup>, Ch. Moreau<sup>4</sup>.*

<sup>1</sup> LSCE, UMR CEA/CNRS 8212, L'Orme des Merisiers CEA Saclay, 91191 Gif/Yvette cedex, France  
[dominique.genty@lsce.ipsl.fr](mailto:dominique.genty@lsce.ipsl.fr)

<sup>2</sup> IDES, Paris-Sud University, bat. 405, 91400 Orsay, France

<sup>3</sup> GEconseil, 30 Rue de la République, 09200 St Girons, France, email: [geconseil@wanadoo.fr](mailto:geconseil@wanadoo.fr)

<sup>4</sup> Laboratoire de Mesure du Carbone 14, UMS 2572 bâtiment 450 porte 4, CEA Saclay, 91191 Gif sur Yvette Cedex

CO<sub>2</sub> radiocarbon measurements made in three different caves from South-France since several years reveal significant differences between caves, within each cave and temporal variations that we try to explain with the help of CO<sub>2</sub> isotopes and other environmental factors (i.e. T, pCO<sub>2</sub>). In all caves, and for all measurements, the <sup>14</sup>C activity of the cave CO<sub>2</sub> appears to be lower than that of the outside atmosphere (from 2 pMC to 13 pMC). At the same period, a CO<sub>2</sub> <sup>14</sup>C activity difference of more than 11 pMC can be observed between two caves that are relatively close each other (70 km), and under similar climate and vegetation conditions. Inside the same cave, differences of more than 2 pMC can be observed; we have noted that more confined parts of the caves have lower <sup>14</sup>C activity and higher pCO<sub>2</sub> compared to parts that are closer to the surface/entrances. Delta<sup>13</sup>C data tell us that the main source of the cave CO<sub>2</sub> is the soil/OM CO<sub>2</sub>, with average values of ~ -23‰ in all three caves (within -20.3 to -24.8‰ limits). There is a strong correlation between d<sup>13</sup>C and pCO<sub>2</sub> : d<sup>13</sup>C increases when pCO<sub>2</sub> decreases, suggesting a mixing of atmospheric and soil/OM sources, especially when the pCO<sub>2</sub> is below 3000 ppmv. In the Villars cave, where we have more frequent measurements, it is observed that the CO<sub>2</sub> maximum occurs in September-October. In the same cave, there is a time offset of ~1.5 month between external mean air temperature and cave pCO<sub>2</sub> maximum, suggesting that there is inertia between the soil/OM CO<sub>2</sub> production and its accumulation in the cave. At the same site, there is a significant opposite correlation between <sup>14</sup>C activity and pCO<sub>2</sub> which, combined with the d<sup>13</sup>C data, suggests that the cave atmosphere CO<sub>2</sub> is contaminated by dead carbon from organic matter degradation which exact source is still unknown (old soil OM, other ?). Apparent present day CO<sub>2</sub> age is 50 years for the Chauvet Cave, 160 years for the Villars Cave and 1000 years for the Cussac Cave. The low CO<sub>2</sub> <sup>14</sup>C activity of this later site is discussed.