CO2 radiocarbon measurements in South-France caves
Interest for the carbon origin and for cave air and hydrology dynamics

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CO2 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 CO2 isotopes and other environmental factors (i.e. T, pCO2). In all caves, and for all measurements, the 14C activity of the cave CO2 appears to be lower than that of the outside atmosphere (from 2 pMC to 13 pMC). At the same period, a CO2 14C 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 14C activity and higher pCO2 compared to parts that are closer to the surface/entrances. Delta13C data tell us that the main source of the cave CO2 is the soil/OM CO2, with average values of ~ -23‰ in all three caves (within -20.3 to -24.8‰ limits). There is a strong correlation between d13C and pCO2 : d13C increases when pCO2 decreases, suggesting a mixing of atmospheric and soil/OM sources, especially when the pCO2 is below 3000 ppmv. In the Villars cave, were we have more frequent measurements, it is observed that the CO2 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 pCO2 maximum, suggesting that there is inertia between the soil/OM CO2 production and its accumulation in the cave. At the same site, there is a significant opposite correlation between 14C activity and pCO2 which, combined with the d13C data, suggests that the cave atmosphere CO2 is contaminated by dead carbon from organic matter degradation which exact source is still unknown (old soil OM, other ?). Apparent present day CO2 age is 50 years for the Chauvet Cave, 160 years for the Villars Cave and 1000 years for the Cussac Cave. The low CO2 14C activity of this later site is discussed.