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Role of the pore structure of soil and rocks in the CO_2 exchange between subsurface and atmosphere.

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Research on CO_2 exchange between terrestrial ecosystems and the atmosphere is now one of the hottest scientific topics. The gas-storage capacity of the uppermost part of the vadose zone is widely known and may represent a substantial fraction of the unknown CO_2 atmospheric sink. For instance, CO_2 levels in caves can reach currently 10–100 times the typical at the surface. The gas composition of subsurface atmospheres (including CO_2 and 222Rn) and the soil and rock petrophyisical properties of several cave sites with different kind and thickness of soil and rocks were monitored. Additionally, experimental results of water vapour transfer on porous soil and host rock were obtained to quantify the variation of diffusion vapor diffusivity coefficient under changing air humidity conditions, which are linked to porous materials with an important capacity to adsorb and condensate vapour water. Results of these studies demonstrate that the soil and host rock act as a permeable/impermeable membrane or barrier controlling CO_2 gas exchange. Gas exchange depends directly on weather conditions and pore structure properties. Therefore, any change in the structural and textural properties of rocks and soils modifies the exchange of CO_2 between the subsurface enviroments and the atmosphere.