Contribution of terrigenous rocks of South Belgian coal deposits in geological storage of CO_2: new opportunities

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Sequestration of CO_2 in unmined coal seams is one of the different options for storing CO_2 in geological reservoirs. In the case of South Belgian coal measures, both weak permeability of the coal and frequent faulting/folding of the seams are likely to decrease the efficiency of this technique.

Westphalian A and B sediments from South Belgium are containing only about 2.5% vol. of coal; the other rocks consisting of shales (~80%) and sandstones (~20%). For all these lithologies, the main processes of CO_2 sequestration are adsorption in coal and clay minerals that are partly forming shales, and within rock porosity in the case of sandstones and, to a lesser extent, in the shales/siltstone porosity. In a previous assessment of the sequestration potential in Westphalian coal measures of South Belgium, Baele *et al.* (2006) showed that coal and shales each account for 25% of the total sequestration potential, and the rest, i.e. 50%, is related to sandstones on a basis of 2% porosity.

The aim of this study is to refine the contribution of the westphalian South Belgium terrigenous rocks (sandstones and shales) to the geological storage of CO_2. Measurements were performed on about forty rock samples in order to determine their mineral compositions and petrophysical properties. The results for the sandstones where introduced in Dupont *et al.* (2009). This paper includes results for the shales.

Effective porosities measured in studied rocks is ranging are about 60% on average higher than the value taken in the previous capacity evaluation, which conduct to increase the sequestration potential in the porosity. Moreover, new estimations of sequestration by adsorption on coal grains and clays minerals of the terrigenous rocks shows that this process could contribute in the same order than porosity sequestration.

Finally, the contribution of each lithologies (coal, sandstones, and shales) in the total sequestration potential is roughly identical to their proportions in the Westphalian (A-B) strata.

Results from this study show other promising insights for the sequestration of CO_2 within Westphalian terrigenous rocks of South Belgium, despite their low permeabilities (few milli-Darcies at best). Carbonate minerals, which occur with 2% in average, could significantly increase the porosity and especially the permeability, due to their dissolution by water acidification caused by CO_2 injection. Adsorption onto coal fragments and clay minerals in the terrigenous rocks has an estimated sequestration potential similar to that of storage in rock porosity. Finally, for reservoir safety purpose, a preliminary assessment of the mineral trapping potential shows that the whole sequestrated CO_2 (within the porosity and by adsorption) could react with CO_2-sensitive minerals such as chlorite and feldspars in the long term.

Baele J.M., Raucq V., De Weireld G., Legrain H., Billemont P., Tshibangu K., Dupuis C. (2007). *Geological Storage of CO_2: New Concepts from Storage Capacity Evaluation in Belgian Westphalian Rocks*. EGU Meeting, Vienna 2007.

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