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A nascent natural CO_2 reservoir: the Mihályi field, Pannonian Basin; Opportunities for geologic carbon storage

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Natural CO_2 reservoirs have played a crucial role in understanding long-term storage of CO_2 [1]. Most natural CO_2 reservoirs has seen the latest CO_2 'injection' millions of years ago. Very young natural CO_2 reservoirs are equally important because they are analogues of early-stage, large-scale industrial CO_2 injections. However, to date the youngest known CO_2 reservoir is thought to be the Bravo Dome (1.2 Ma, USA) [2].

The Mihályi field is part of the Mihályi-Repcelak area (Pannonian Basin) where 20 Mt CO_2 is trapped in sandstones. The Mihályi reservoir is at the depth of 1.4 km. The Répcelak reservoir is slightly shallower and locates 20 km to the southwest. Stable and noble gas isotope studies suggested the origin of the CO_2 to be late Miocene magmatic degassing for both fields [3-4].

New Ne isotope measurements of gases sampled in 2017 and 2019 suggest the age of CO_2 to be 8 ± 3 Ma from the Répcelak field, confirming previous studies [4]. In contrast, Ne isotopes in CO_2 from the Mihályi field are consistent with recent derivation from magmas derived from sub-continental lithosphere. Mineralogical observations on reservoir core samples also suggest recent formation of dawsonite. Hydrological studies suggest no connection between the deep Mihályi and the shallower Répcelak field, which rules out CO_2 migration from one to another. The field is tectonically active, the most recent earthquake was in September 2021 (m = 3). It might be that active recent tectonism opened path for magmatic volatiles to be trapped in the reservoir. We suggest that the Mihályi field is so far one of the youngest CO_2 reservoirs in the world, and thus it may prove to be an analogue for the early stage of large-scale CO_2 injection into sedimentary reservoirs.

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