IMPACT OF GEOGENIC CO_2 ON DEEP MICROBIAL ECOSYSTEMS IN THE HARTOUŠOV MOFETTE SYSTEM IN NW BOHEMIA

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A mofette is a natural cold either dry or wet gas vent releasing CO_2-rich gases into the atmosphere. The Hartoušov mofette system is located in the northern Cheb Basin (NW Bohemia, Eger Rift). The area is characterized by active seismicity in form of periodically occurring swarm earthquakes and lithospheric mantle derived gas emanations (> 99 % CO_2). The exhaling free gas phase of the Bublak mofette, the best investigated degassing site of the area, shows CO_2 with a comparatively heavy $\delta^{13}C$ signal (ca. -2 ‰) compared to atmospheric CO_2 (ca. -8 ‰) (MANGELSDORF ET AL., 2008) and is characterized by a subcontinental mantle helium isotope signature of 5.9 Ra (BRÄUER ET AL., 2011). Magmatic fluids from lithospheric mantle, entering the whole crust, are the main reason for periodic/episodic earthquake swarm activity in this area (BRÄUER ET AL., 2003).
In early 2016 a borehole was drilled by GFZ in the framework of a DFG-ICDP project (Alawi, AL 1898/1). The drilling was performed in a mofette system near the village of Hartoušov. Below a Holocene sediment cover the 108.5 m deep borehole exposed Quaternary to Pliocene sand and gravel, laminated to bedded lacustrine Miocene claystones, a compact sandy claystone and a weathered Palaeozoic basement. During the drilling campaign CO_2-rich sediments were recovered between 73 m and 76 m depth representing a sandy aquifer bordered by marlstone layers. After penetrating a deeper marlstone layer at 78.5 m a CO_2 blow out occurred indicating a CO_2 reservoir below this layer in the sandy clay (Figure 1). A pumping test between ca. 80 m to 90 m depth revealed the presence of mineral water dominated by Na^+, Ca^{2+}, HCO_3^-, SO_4^{2-}.
The ascending CO_2 is not only affecting the sedimentary matrix as indicated by high mineral contents and dissolved CO_2 in groundwaters, and presumably causes mineral alterations along vein-like structures and possible carbonate precipitations at the boundaries of CO_2-containing aquifers, but can also act as a substrate for deep microbial ecosystems. Thus, the aim of the current study is to investigate both the impact of geogenic CO_2 on deep microbial communities and on their surrounding sedimentary life habitat.
In this context the sedimentary succession from 65 to 95 m depth will be examined for the abundance and distribution of specific microbial biomarkers indicating living (phospholipids, PLs) and past (archaeol and glycerol dialkyl glycerol tetraethers, GDGTs) microbial communities. Compound specific carbon isotope analyses on these microbial markers will be used to unravel links between the geogenic CO_2 and the indigenous microbial communities, since the geogenic CO_2 differs in its isotopic signals from the sedimentary terrestrial or lacustrine organic material.
In addition the life habitats for the deep microbial ecosystems will be assessed for potential substrates others than CO_2 and for electron acceptors probably provided by mineral dissolution and groundwater transport. Furthermore, the impact of CO_2-containing fluids on the sedimentary matrix will be investigated by characterizing the mineralogical rock composition and gas-migration pathways through vein-like structures both with related mineral alterations.

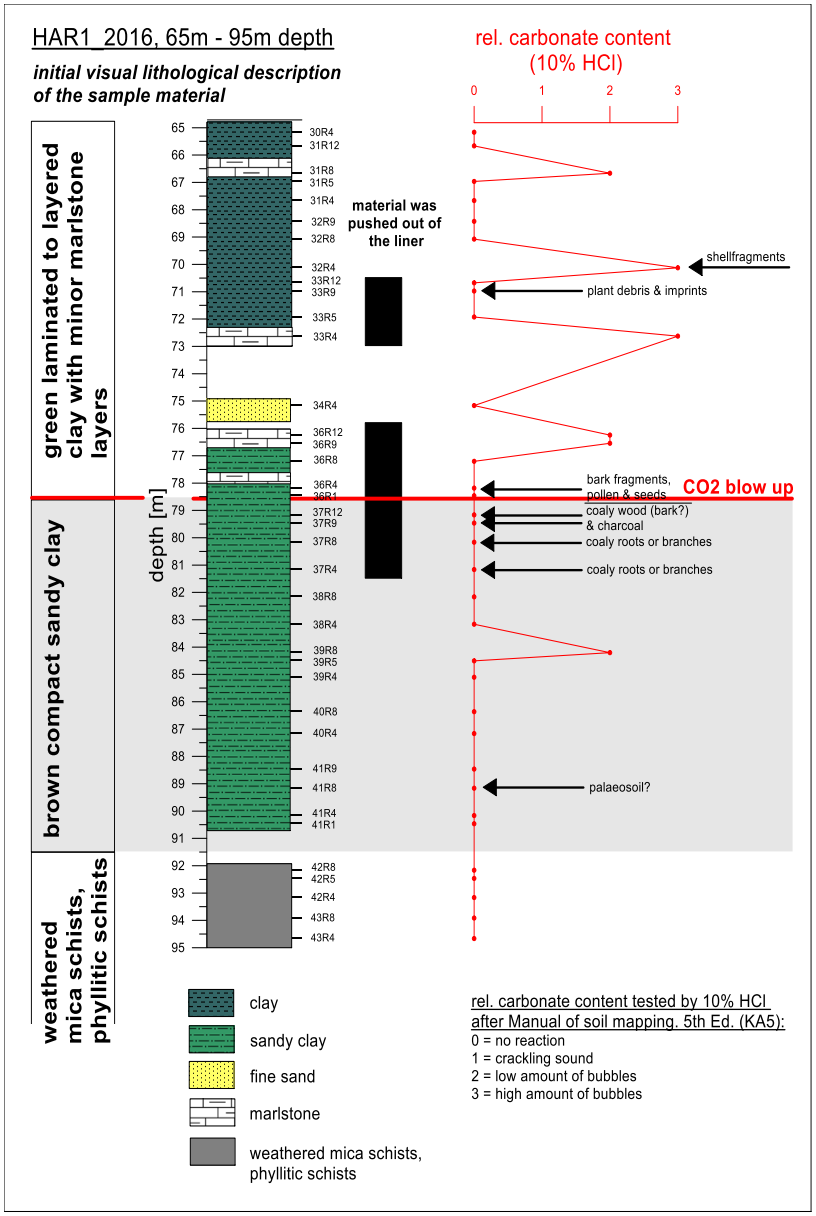

Figure 1 *Initial visual lithological description for the depth interval 65 m - 95 m of the HAR1 borehole drilled into the Hartoušov mofette system.*

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References

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