Environmental parameters that determine distribution coefficients of radionuclides for repositories

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In order to treat radionuclide sorption processes in natural systems more realistically, temporally and spatially variable distribution coefficients (smart K_d-values) are calculated as a function of important environmental parameters such as pH, ionic strength (IS), concentration of dissolved inorganic carbon [DIC], calcium [Ca] and radionuclides [RN]. This smart K_d-concept is implemented into the transport code r³t [1].

As a test of the modified code r³t and the sensitivity analysis of radionuclide sorption regarding the mentioned environmental parameters, a possible future climate transition (seawater transgression) at Gorleben site / Germany was modelled [2]. Seawater inundation drastically influences the distribution and values of all environmental parameters. Chemical changes cause dissolution or precipitation of calcite and these in turn affect the pH, DIC and Ca concentration. In consequence the K_d-values and therewith the transport of radionuclides is impacted.

The results of the calculations are plausible: environmental parameters follow expected trends and major dependencies. As a consequence of the low Ca and DIC concentration in seawater, calcite dissolves in the aquifer and causes an increase of the pH. The K_d-values change according to the changes in environmental parameters. The pH has the most dominant impact on the smart K_d-values for most of the considered RNs, except for Pu and Th, for which the DIC concentration has the strongest impact. Under the assessed conditions for seawater transgressions the smart K_d-values of Cs, Ni, Am and Np(V) increase, those of Se(VI) and U(VI) decrease with increasing pH. The smart K_d-value particularly of Pu and Th decreases with increasing DIC concentration.

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[1] Fein (2004) Report GRS-192 [2] Noseck et al. (2012) Report GRS-297

Detrital zircon U/Pb ages on sedimentary rocks from the South Carpathians, Romania and implications for regional tectonic provenance

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We present new detrital U/Pb zircon ages on six sands and sandstones collected from the South Carpathians, Romania. The Southern Carpathians have a nappe structure assembled during Middle to Late Cretaceous Alpine continental collision, consisting of several thrust nappes: the Getic-Supragetic nappe system, the underlying Severin complex and the lowermost Danubian nappe system, each composed of several amalgamated blocks of different affinities [1]. The analyzed rocks are: 3 mid-Cretaceous sanstones from Bucegi Mountains, one latest Cretaceous from Cozia Mountains, one Quaternary sandstone and one modern sand from Pianu Valley, north from Sebes Mountains. Our LA-MC-ICPMS U/Pb ages on detrital zircons confirm periods of magmatism in the Neoproterozoic and Cambro-Ordovician, as well as an episode of metamorphism in Late Devonian to Carboniferous documented by high U/Th ratio zircons.

The three early Cretaceous sedimentary rocks, collected from Bucegi Mountains, contain detrital zircons of different crystallisation ages ranging from 2.7 Ga to 340 Ma, but mostly clustering around 500 Ma. The predominant Neoproterzoic (550–850Ma) and Cambro-Ordovician (450-520 Ma) zircons indicate subaerian exposure of Leaota metamorphic unit in Aptian. Precambrian tectonics is documented by inherited zircons (cca. 900-1200 Ma, 1800-2200 Ma, 2600-2800 Ma), most likely recycled from Cumpana metasedimentary rocks due to their similarity in age distribution.

In the other samples, the most prominent population occurs between 450 and 500 Ma, followed by less abundant age group between 550 and 800 Ma. Older ages are also present but less frquent frequencies than in the early Cretaceous samples.

Age distribution patterns from all samples are consistent with derivation from basement rocks of the Getic-Supragetic thrust sheets and no contirbutions from Danubianunits.

[1] Balintoni *et al*. (2009) *Gondwana Res*. **16**, 119-133.

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