average flow velocities of 1.4-4.5 mm per day near the front for the period 2006-2011. Two cores were drilled on the lower part of the rock glacier during late summer of 2010. Core I is 40 m long and penetrated the active layer (0-2.8 m), the frozen core extend from 2.8 to 24 m. Below the frozen core coarse debris with small amounts of fine-grained sediment is present to a depth of 28 m, followed by lodgement till. The average ice content is 43 vol%. At core II, which was drilled close to the front, the active layer is 4.5 m thick, underlain by the frozen core down to a depth of 18.5 m. The ice-content is lower compared to core I averaging 22 vol%.
From the frozen cores samples were taken at an interval of approximately 10 cm for geochemical analyses, isotope studies, palynology and radiocarbon dating. Temperature loggers were installed in the borehole of core II to record the temperature within the bore hole. Inclinometers were installed to obtain information on the movement of the rock glacier. Borehole measurements, geochemical and palynological data and radiocarbon ages provide important information on the formation and dynamics of this active rock glacier.

Isotopic and chemical evidence on the transition unsaturated - saturated zone: From the lysimeter to groundwater body scale, Wagna, Leibnitzer Feld

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Isotopic behaviour, hydrochemical exchange and transport velocities in the unsaturated zone and at the transition unsaturated and saturated zone is still relatively unknown in many groundwater bodies. At the lysimeter station Wagna (Leibnitzer Feld, Styria, Austria) a dense depth-profile (n=24) over the transition unsaturated and saturated zone was sampled 6 month after an unusual wet summer. On all samples oxygen and hydrogen isotopes as well as major ions were analysed. Tritium was measured at the top and the bottom of the saturated zone. The heavier isotopes and the smaller ion-concentration in the water of the unsaturated zone approach the surface of the saturated zone with a gradient. This gradient continues in a steep form over the depth of the saturated zone. The tritium content on top of the saturated zone is significantly higher than at the bottom of the zone (11 and 9.7 TU). All the major ions are less concentrated in the unsaturated zone with the exception of nitrate. The summer precipitation seem to have arrived quicker than normal at the saturated zone in the depth from 2.3 m and mix with the thin aquifer of about 2 meter. Isotope data of 14 monitoring sites in the groundwater body around the lysimeter allow to unravel the timing and the equal importance of the summer precipitation for the groundwater recharge in unconfined aquifers in humid climates.

Where does Nitrogen, Sulphur and Lead go in a forested Alpine watershed? The relation of “water age” and the retention of N-, S-, O, DIC, Sr and Pb by a multi-isotope approach, Zöbelboden, Reichraming.

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In a pilot study precipitation, soil, rock and spring waters were collected in a small catchment at the front of the Northern Calcareous Alps to test the application of isotope analyses to estimate the mean transfer time, the amount of nutriens, contaminants and their transfer to the groundwater. The hydrochemistry and the isotopic composition of nitrate, sulphate, strontium, lead and the water molecule itself has been analysed in five laboratories.
The transfer-time of precipitation through soil and groundwater was estimated by oxygen-18, tritium and 3H/3He measurements.
Comparison of strontium isotope measurements in precipitation, spring waters and dolomite bedrock in a relatively pristine and remote area at the front-range of the Northern Calcareous Alps in Austria with literature data indicate that 87Sr/86Sr-isotope ratios in precipitation (0.7092) support at least a more radiogenic, far transported source in addition to a possible recycling of local dolomite and limestone dust (0.7080-0.7083). Spring waters show similar ratios (0.7083-0.7084) confirming Sr-isotopes are good indicators for groundwater contact with specific host rocks.
The monthly precipitation samples show 18O-rich sulphate ions, whereas the soil sulphates change in a direction

to lower 18O- and higher 34S-values with depth. The spring waters and the bedrock dolomites vary in the range of δ34S-values (4-9 ‰). Assuming the precipitation samples and the dolomite bedrocks are end-members the straight contribution of atmospheric sulphate without biogenic cycling can estimated to be 20 % in the spring waters and 10-45 % in the soil samples.
The monthly precipitation and total deposition samples show 18O-rich nitrate ions, whereas the spring waters show variable influence of soil nitrates. Assuming the field of soil nitrification and the precipitation as end-members a direct atmospheric nitrate contribution of 10-30 % derived from fossil fuel burning and agricultural emissions can be calculated.
Radiogenic Australian gasoline-lead still dominates with 60-80 % the composition of the trace lead in the spring waters. In addition to the lead leached from the dolomite bedrock a third source contributes about 5-10 %. This second long distance Pb-contribution may originate from coal burning and/or Ag-Pb-ore smelting in Central Europe in the past.

Heterogeneous mean transfer-times in an Alpine dolomite-karst massif, Zöbelboden, Reichraming, Austria: δ18O, 3H, 3H/3He, CFC, SF6, chloride and dye tracer – investigations

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According to the European Water frame Directive it is a requirement that surface and groundwater in the EU should show good quality conditions by 2015. For the implementation of this goal it is necessary that any measures to improve groundwater quality show an impact within the upcoming 5 years. A prerequisite for any change of groundwater chemistry within this time frame is that the mean residence times of the groundwater bodies are shorter than 5 years.
A dolomite massif at the north front of the Eastern Alps (Upper Austria) was examined to establish the water cycle in respect of mean residence time (MRT) and recharge area with various isotope systems and tracer chemicals. Besides a previous tracer test for quick water movements during storm events (days) along karstified fracture zones, oxygen-18, deuterium, chloride and tritium were analysed over a time period of 20 years to estimate the MRT of the groundwater in this fractured dolomite aquifer. In addition, 3H/3He, CFCs and SF6 were analysed twice at two springs covering a young (month) and an old water discharge (~20y) characteristic for karstwater dynamics.
The oxygen-18 and deuterium measurements fit well in the altitude dependent oxygen shift (0.2 ‰ / 100m) and indicate a water recharge close to the plateau of the dolomite massif at an altitude of 800-900m. A small shift towards higher deuterium excess in the springs compared to the valley precipitation in a nearby station indicate that part of the precipitation evaporates and is included in the rain at the top of the mountain plateau.

Moderne Kieselschwammriffe - zum Aussterben verurteilt?

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Kieselschwammriffe traten in der Erdgeschichte häufig auf und erreichen im Oberjura ihre maximale Verbreitung. Auf dem Nordschelf der Tethys bildete sich ein über 7000 km langer Tiefwasser-Riffgürtel, der vom Kaukasus über Mitteleuropa bis nach Oklahoma reichte. Die süddeutschen Schwammriffe der Schwäbisch-Fränkischen Alb sind seit langem bekannt und waren schon früh Gegenstand wissenschaftlicher Untersuchungen.
In nachjurassischer Zeit ging die Schwammfazies sehr stark zurück und man nahm an, dass die letzten Kieselschwammriffe im Tertiär ausgestorben wären. Vor einigen Jahren hat man jedoch vor der Westküste Kanadas solche Kieselschwammriffe wieder entdeckt. Sie wurden in einem deutsch-kanadischen Projekt mit modernen wissenschaftlichen Methoden eingehend untersucht. Durch Grund berührende Schleppnetzfischerei sind die fragilen Riffe massive gefährdet und ihre flächenmäßige Verbreitung beläuft sich noch auf etwa 1000km^2. Große Bereiche sind bereits zerstört. In Zusammenarbeit mit NGOs und staatlichen kanadischen Institutionen wird versucht die Riffe als MPA (marine protected area) unter dauerhaften Schutz zu stellen. Dies mit dem Ziel,