Notes for sampling:

most important in brief

Sampling of groundwater for noble gas analysis:
- use transparent hose to connect Copper tube with pumping line
- connect a short transparent hose with the other end of the tube and narrow it to increase the water pressure in the tube or connect a valve and a manometer
- raise the outlet of the tube by approx. 45°
- flush the tube (40 cc) at least 10 times
- meanwhile hit the aluminium rack with a stiff tool (ratchet wrench), to release air bubbles from the inner walls of the tube. IMPORTANT!!
- screw down real tight **first outlet, then inlet**
  Planar surfaces of the clamps must rest on back-to-back
- don´t bend, squeeze, or do the like to the ends of the tube
- don´t forget to label the tube!!

The wall thickness of the tube is 1mm. The clamps are made in a manner, so that the copper will be squeezed down to 0.7mm. By that the Cu-tube is absolutely helium tight and can stand a high inner pressure and the sample can be stored for years.

Sampling of groundwater for tritium analysis:
- the sampling container (plastic or glass bottle) muss be dry.
- flush the bottle with low water pressure. Try to reduce foaming and bubbling.
- avoid contact of the hose with the ambient matter.
- amply spill the bottle gently
- pour out some water (1-5cc) and seal the bottle with a dry closing.

Contact of the sampled water with the ambient water should be reduced to a minimum. The tritium concentration of the ambient water might be 1000times higher that in your sample.
Luminescint watches can contain extremely high amounts of tritium. Wearing such watches should be strictly avoided.
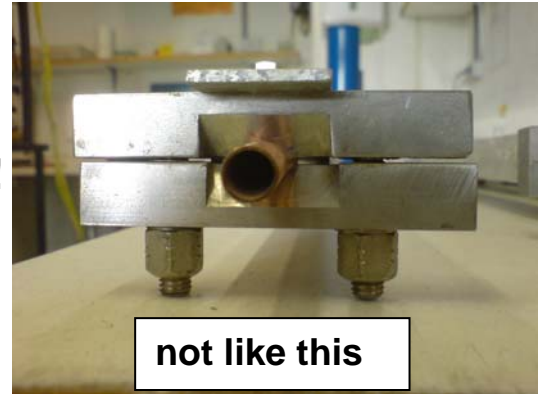
any questions?
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Samples for Helium-Isotope-Analysis

sampling

IMPORTANT: close clamps completely!

There should be no gap visible!

not like this

Important: labeling

Name of institute resp. company /

sequential number of well in this campaign /

name of well /

sequential number of sample (each sample gets its own number!)

Inst.of Water **/** 3 **/** toad spring 3a , 70m **/** 7

wooden sticks in boxes need to be placed like they were found, i.e. to the outer end of the upright bars. So, tubes can not slide.

Send digital sample list when shipping the samples.

Samples for Tritium Analyses:

Sampling:

fill 1000ml water in dry bottles: plastic or glass is ok

leave some ml for volume change

Important: labeling

Name of institute resp. company /

sequential number of well in this campaign /

name of well /

sequential number of sample (each sample gets its own number!)

Inst.of Water **/** 3 **/** toad spring 3a , 70m **/** 7

Send digital sample list when shipping the samples.

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background of the procedure for Helium-Sampling

(absolutely to read !)

Groundwater should be analysed for Helium- and Neon-Isotopes (^{3}He, ^{4}He, ^{20}Ne, ^{22}Ne).
These lightweight noble gases move very fast in water. Also most materials can not be used for sample-containers because of the mobility of the gases. Copper (Cu) tubes have been proved to be a good choice. Cu-tubes will be squeezed at their ends and also can be stored for years. It is important that the ends remain undamaged!

The quality of the analysis depends very much on the contamination of atmospheric air during the sampling. The concentration of the isotopes can be measured better than 0.5%. An air bubble of 2mm^3 contains such quantities of gases. The Cu-tube are degreased on the inner walls, so water can establish a good contact to the copper and air bubbles will lose their adhesive strength. During filling of the tube one should take care that no air bubbles will be released from the pumping line. To monitor that a transparent hose should be use to connect the pumping line with the tube. However we strongly recommend to hit the aluminium rack with a stiff object during flushing to remove possible air bubbles from the tube.

Groundwater from large depths can contain large amounts of gases according to the hydrostatic pressure. For example, water from a water column of 10m can contain twice as much gas (e.g. CO_2, CH_4, H_2S) as at surface conditions (altitude = 0m). If the water is transferred to the surface the hydrostatic pressure is reduces and the oversaturated gas escapes in form of bubbles. Other dissolved gases, like the noble gases, will diffuse into these bubbles, where the partial pressure is low at first. The time interval of this process is short. This means the degassed proportion of the faster helium is larger as the degassed proportion of the slower neon.
Because of possible degassing, one should try to obtain a high water pressure in the Cu-Tube (> hydrostatic pressure of sampling depth). This can be achieved if a valve and a manometer is connected to the outlet of the tube. Is this not available one can put a hose clip onto the hose to increase the pressure and increase the flux.

Samples for noble gas analysis should be taken with submerged pumps. The pump MP1 made by Grundfos has been proven to be suitable.

Perfect for sampling are closed boreholes. Open wells may have equilibrated their gases with the atmosphere to a large extent. Boreholes should be flushed quite amply. Also the tube and all hoses should be flushed broadminded. If various hoses are connected the diameter should decrease in flow direction. Otherwise there might be cavities, where water can degas. Bubbles may form which move individually with the flow and therefore the gas concentration in the tube will fluctuate.

For the evaluation some sample parameters are needed:
- the temperature of the sampled water
- the salinity, if significant (> 1g/L)
- the altitude of the sampling location
- the altitude of the assumed infiltration area
- the assumed temperature of the infiltration temperature

necessary tools:
- ratchet wrench with 13mm-nut
- 2 transparent hoses with inner diameter of 10mm
- 1 valve and a manometer or a hose clip
- various other connecting pieces

At least 2 Cu-tubes should be fill for each sample.
Also if sampling conditions do not seem to be perfect (large gas build up in the aquifer) there is still a good chance to come to robust interpretation of the sample data.

Cu-tubes with aluminium rack will be provided by us in wooden boxes. One box can contain 24 racks and has the size of 43*107*27cm and a weight of 45kg.

Put the wooden stickes exactly like on the photo

Some photos:

fig. 1: flush the hose and attach it to the Cu tube. Fix the hose on the Cu with a clip

fig. 2: hit the aluminium rack with (most convenient here with the rachet)

Keep the outlet upwards!!

fig: 3: close outlet first. fig. 4: keep hose on the Cu tube until also inlet is closed.

If water is salty please flush end
to prevent corrosion like on the
photo

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