Hydroisotop

Application of natural isotopes in the environment for age evaluation of groundwaters

WATER

GEOTHERMAL ENERGY

TRACER TESTS

POLLUTANTS

FILTER TECHNIQUES

FOOD

RENEWABLE RESOURCES

ISOTOPES

GASES

SOLIDS

ANALYSIS

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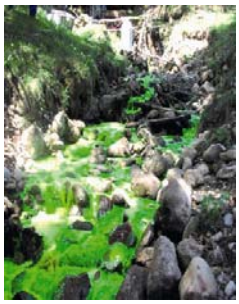
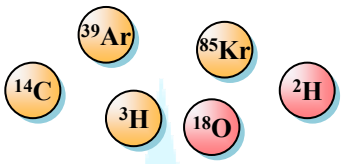
accreditated accoriding to DIN EN ISO/IEC 17025:2005

Isotopy & Chemistry in Environmental Hydrology & Food



ENVIRONMENTAL ISOTOPES



Oxygen-18 (^{18}O)
Deuterium (^{2}H)
Tritium (^{3}H)
Krypton-85 (^{85}Kr)
Carbon-14 (^{14}C)
Argon-39 (^{39}Ar)

- **Origin of groundwater and specific water ingredients**
- **Age dating of groundwater**
- **Characterization and quantification of different water components**

Measurement and evaluation

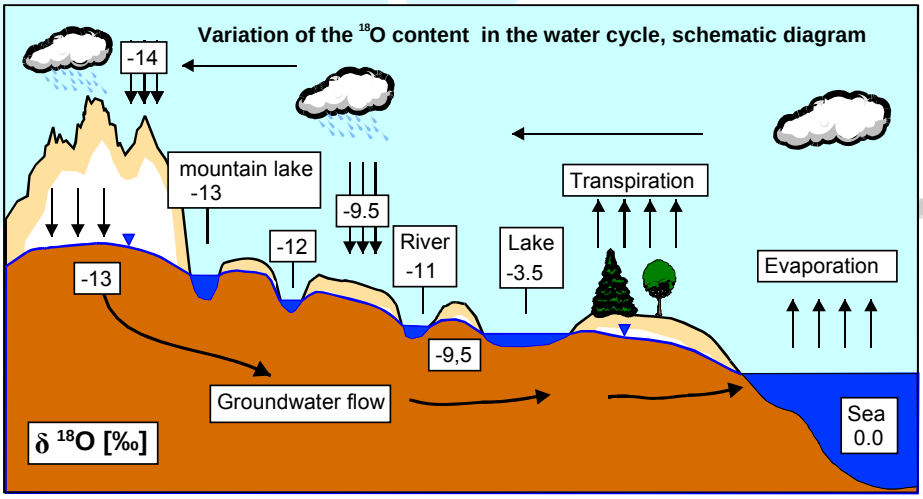
Hydrogeological interpretation

- **Determination of representative hydraulic conductivities**
- **Quantification of lateral inflows**
- **Migration rates of pollutants**
- **Changes of hydraulic relations, e.g. due to intensive use**

General background of isotope hydrology

Most chemical elements have **isotopes**. For example, Hydrogen has two stable isotopes, ^{1}H (99,99 %) and ^{2}H (Deuterium), as well as the radioactive isotope ^{3}H (Tritium).

Physical, chemical and biological processes change the isotope composition. These changes lead to locally and temporally characteristical markings of precipitation and therefore, to locally and temporally characteristical markings of the different water bodies involved in the water cycle.








STABLE ENVIRONMENTAL ISOTOPES

^{2}H ^{18}O

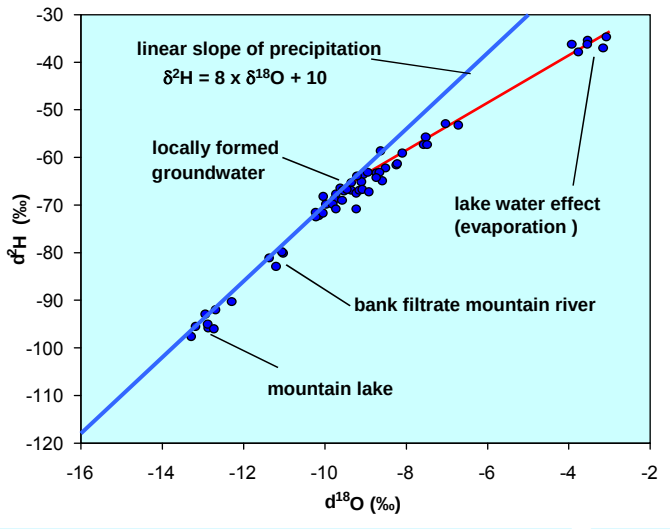
The isotope contents of ^{2}H and ^{18}O in water are related to the international Standard "Vienna Standard Mean Ocean Water" (VSMOW) and written the δ-notation.

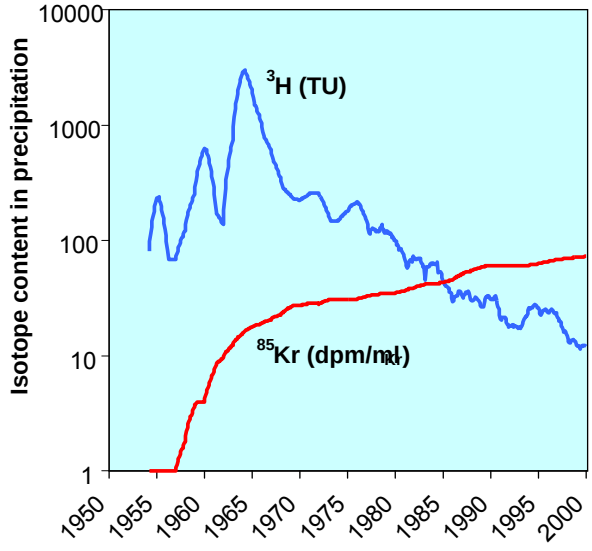
By measuring the $\delta^{2}H$- and $\delta^{18}O$ values of water, characteristics like recharge altitude and climatic conditions as well as evaporation processes can be identified and used to process hydrological questions.

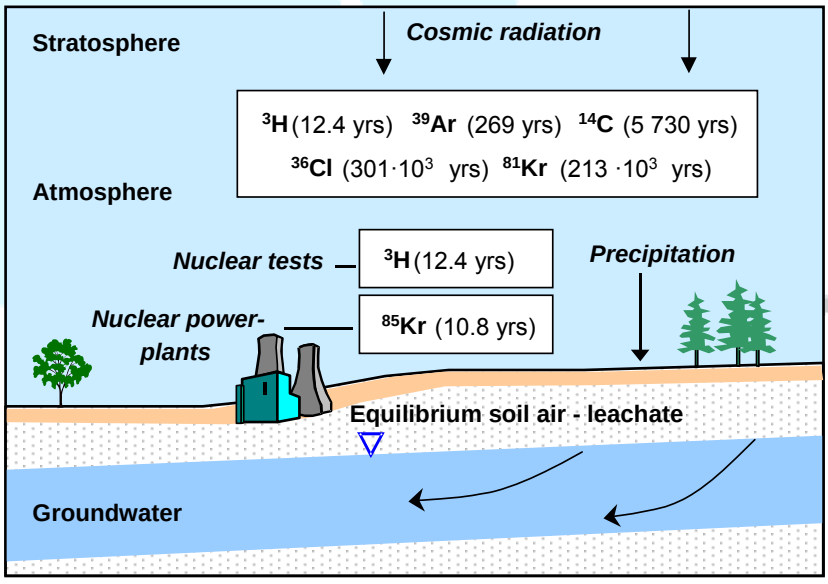
RADIOACTIVE ENVIRONMENTAL ISOTOPES

^{3}H ^{85}Kr ^{39}Ar ^{14}C

The radioactive isotopes in the environment mark the surface waters globally. In addition to the impact of cosmic radiation in the upper atmosphere, mainly anthropogenic activities contribute to the origin of radioactive isotopes in the environment.
Thus, the major part of ^{3}H originates from nuclear bomb tests in the 1960ies, while, e.g. ^{85}Kr is released recently from nuclear facilities.
Their input to groundwater is directly related to precipitation (^{3}H) or to dissolved soil gas during percolation (^{85}Kr, ^{39}Ar, $^{14}CO_2$).





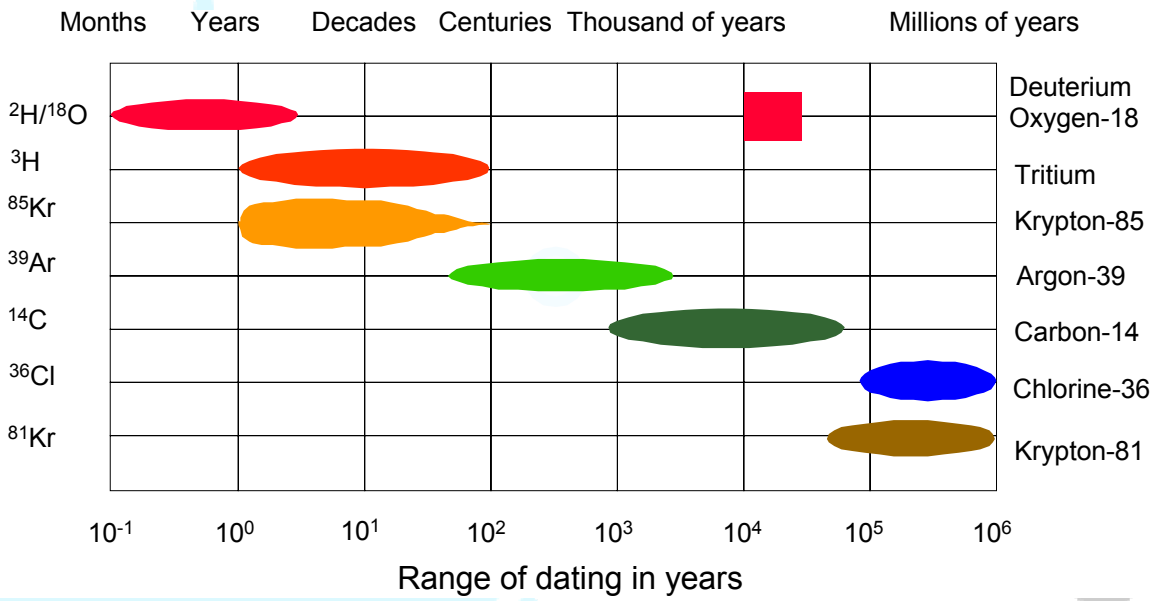






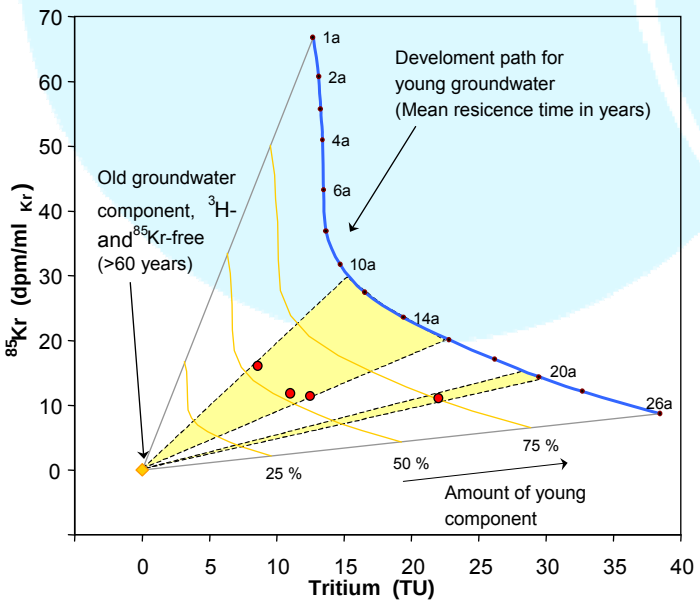

GROUNDWATER AGE AS CALIBRATION PARAMETER

Natural environmental isotopes allow the acquisition of a large time and distance scale in a range of days to thousands of years.



Young groundwater

The contemporaneous determination of ^{85}Kr und ^{3}H allows a quantification of age as well as a quantification of the portions of groundwater components younger than 55 years.



Palaeo groundwater

Age dating of old groundwater is carried out by the ^{39}Ar und ^{14}C contents. The contemporaneous determination of ^{39}Ar und ^{14}C allows an identification and quantification of involved mixing components.