Karóra a vízmolekulán

Palcsu László

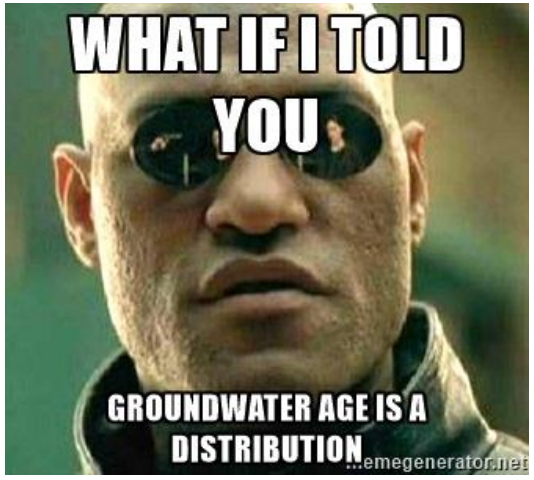
Izotópklimatológiai és Környezetkutató Központ

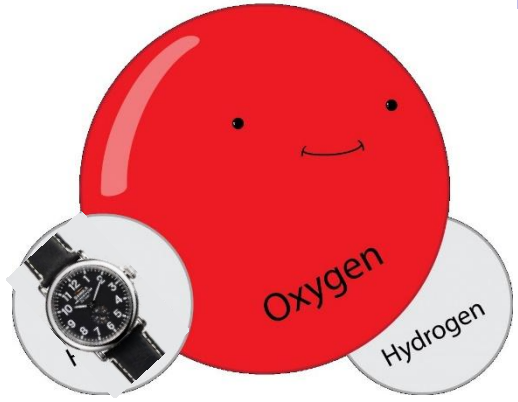
MTA Atommagkutató Intézet

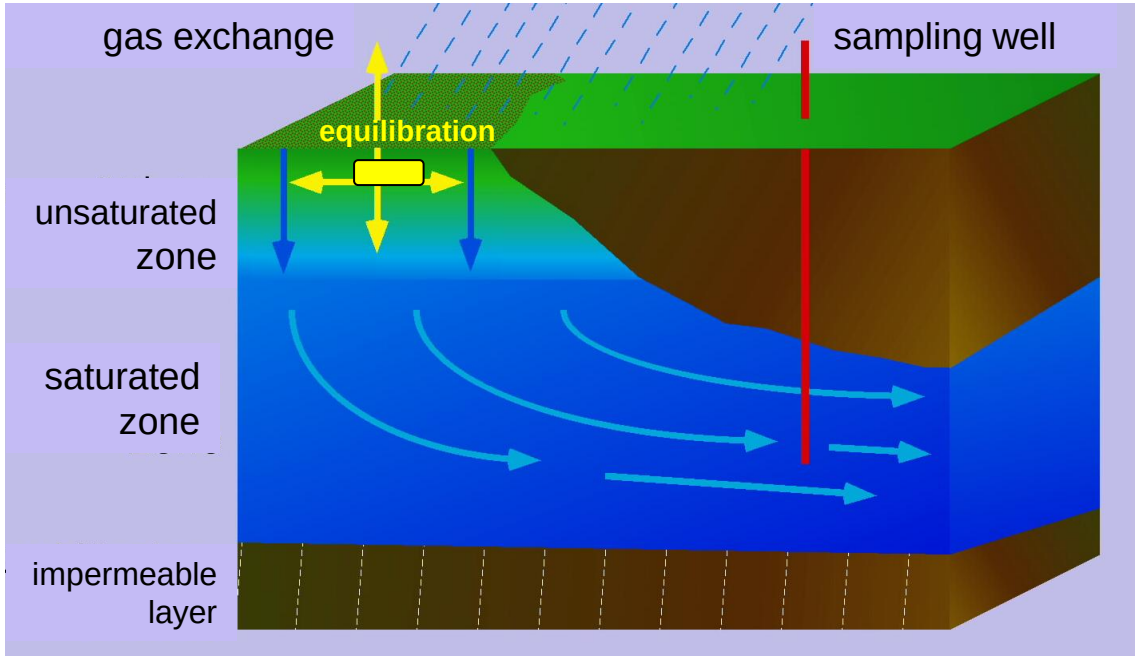
Debrecen

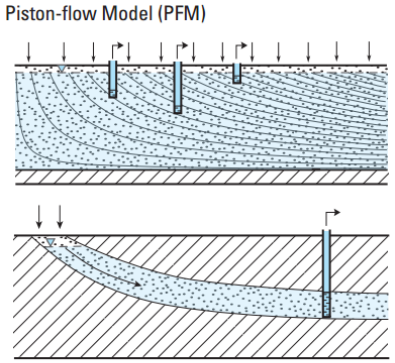
Mit jelent a (látszólagos) vízkor?
Mi az az átlagos tartózkodási idő?
Mi az áthaladási idő?
Mit kell koreloszlás alatt érteni?
Mire jó mindez?

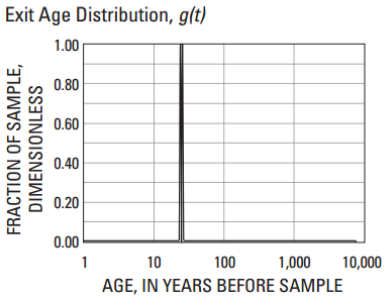
A vízkor egy idő dimenziójú mennyiség, ami segít abban, hogy meghatározzuk a koreloszlást (és ezáltal a víztartó fontos paramétereit: térfogat, keveredési/hígulási viszonyok, válaszidő, stb.).

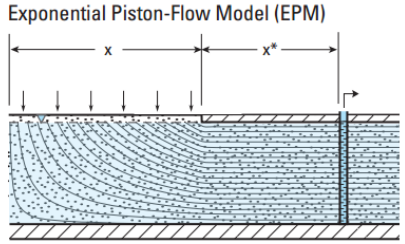


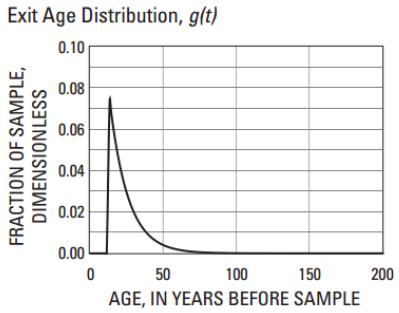


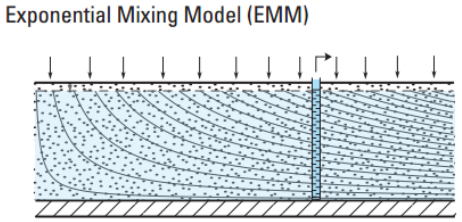


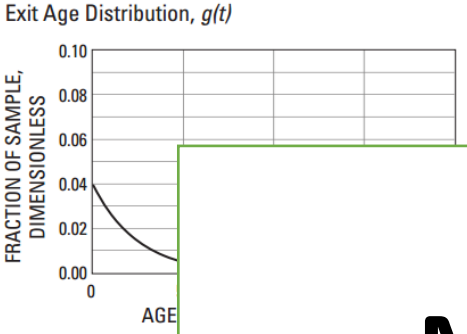


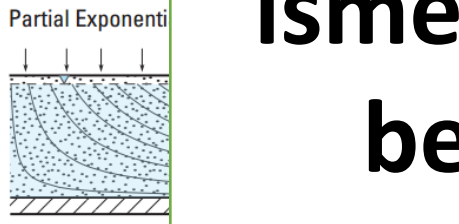


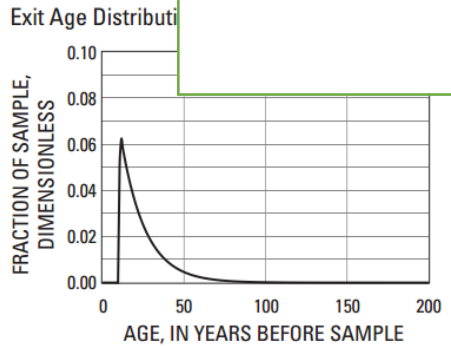


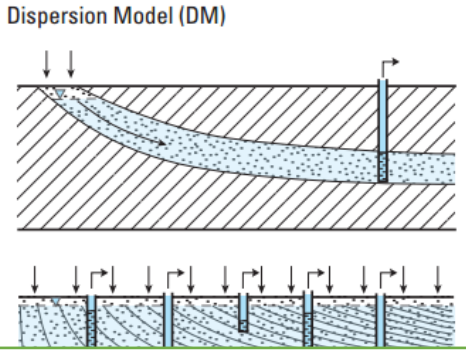


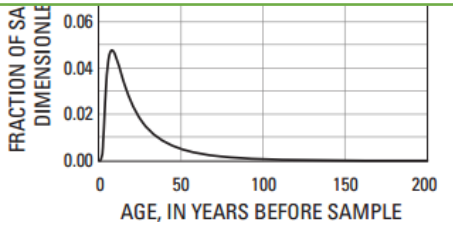












A lényeg:
Minél több korjelzőt ismerünk, annál pontosabb becslést tudunk adni a koreloszlásra.

USGS: TracerLPM (Version 1): An Excel® Workbook for Interpreting Groundwater Age Distributions from Environmental Tracer Data

Radioaktív bomlás, mint óra.

Basic Decay Equations

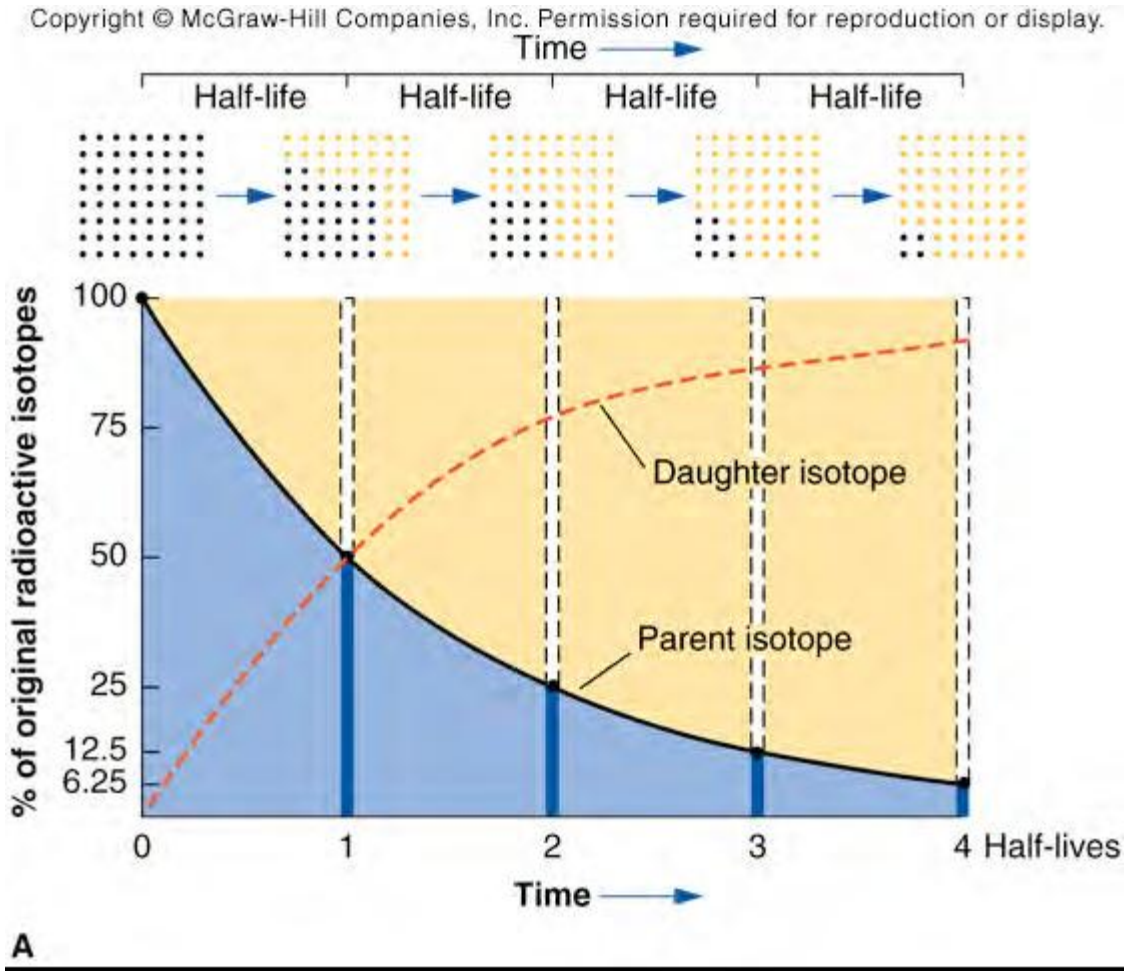
$$\frac{-dN}{dt} = \lambda N$$

$$\frac{dN}{N} = -\lambda dt$$

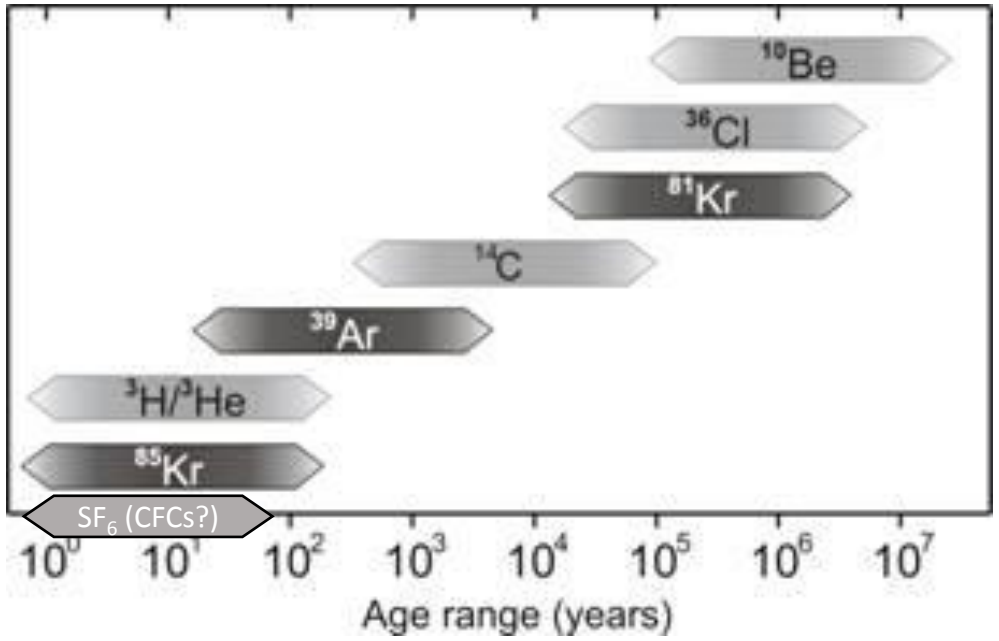
$$N = N_0 e^{-\lambda t}$$

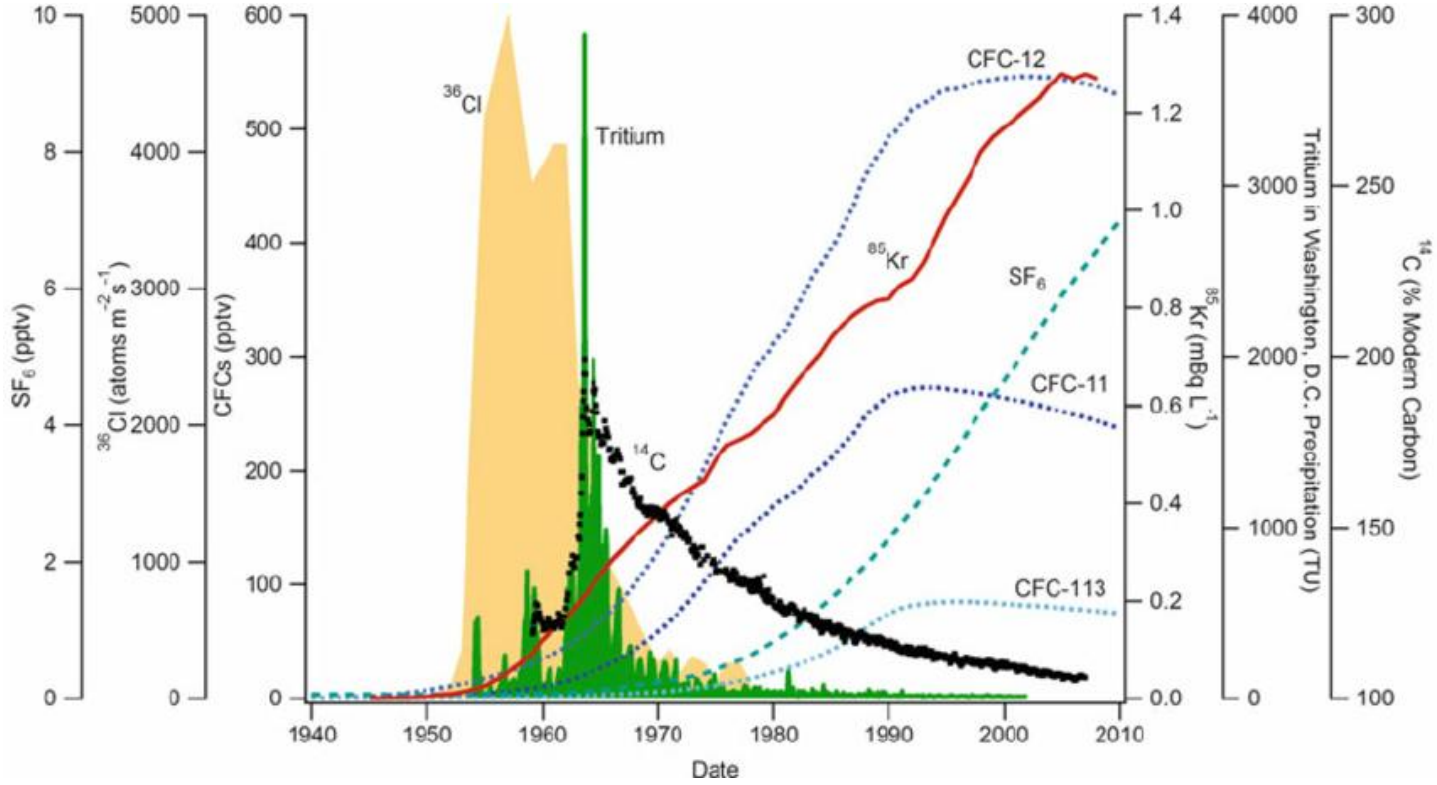
D = daughter atoms
N= parent atoms remaining

Half life: characteristic time it takes for half of the parent atoms (N) to decay:

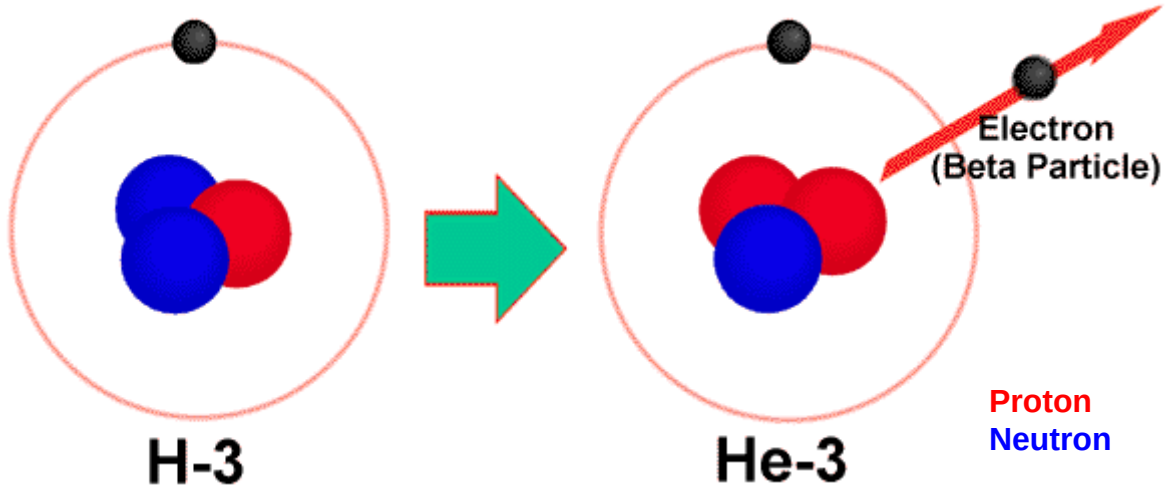


Vízkor-meghatározási módszerek





$^3H/^3He$ kormeghatározás elve

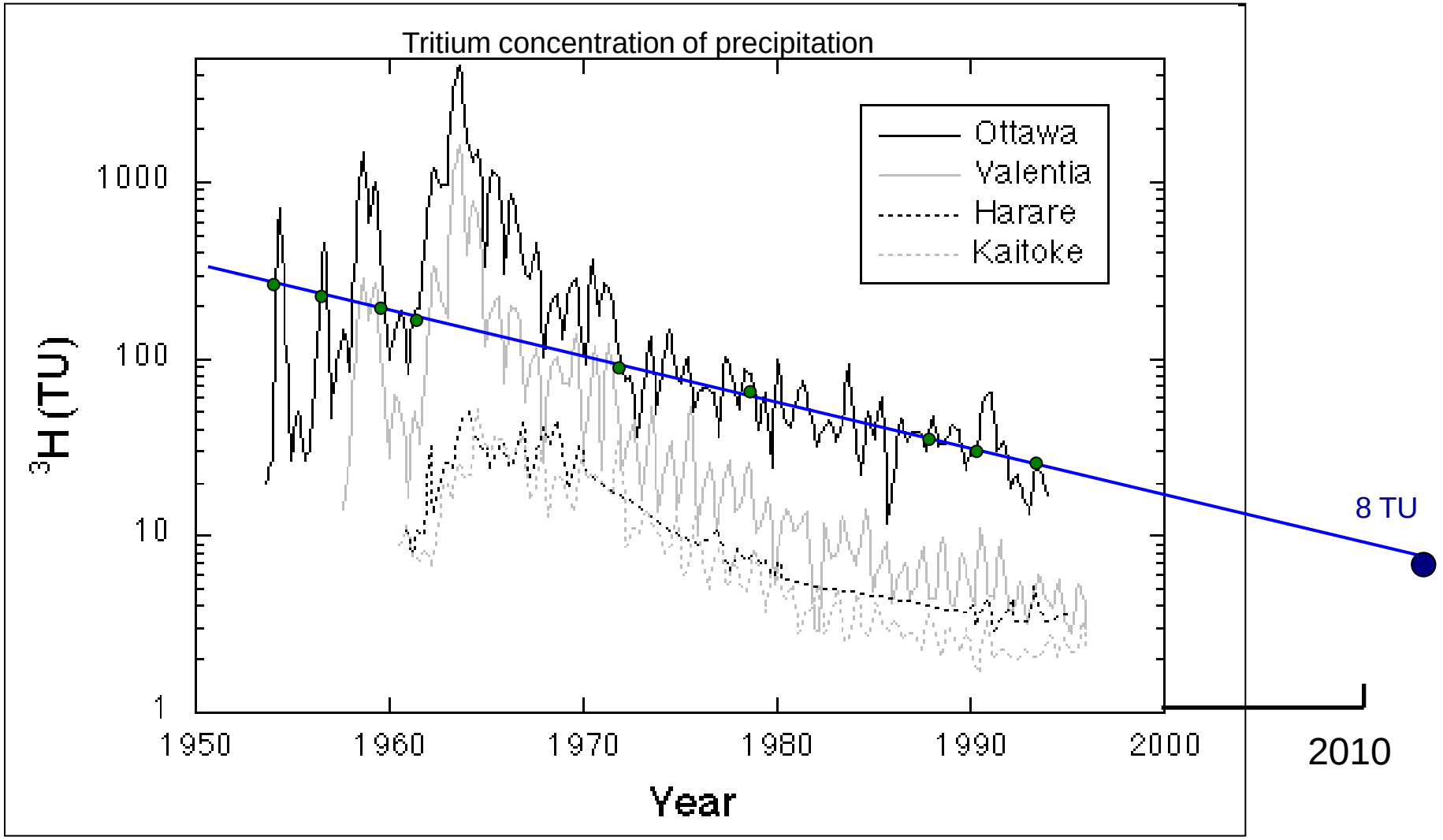


$$t = \frac{1}{\lambda} \cdot \ln\left(\frac{^3He_{trit} + {}^3H}{^3H}\right)$$

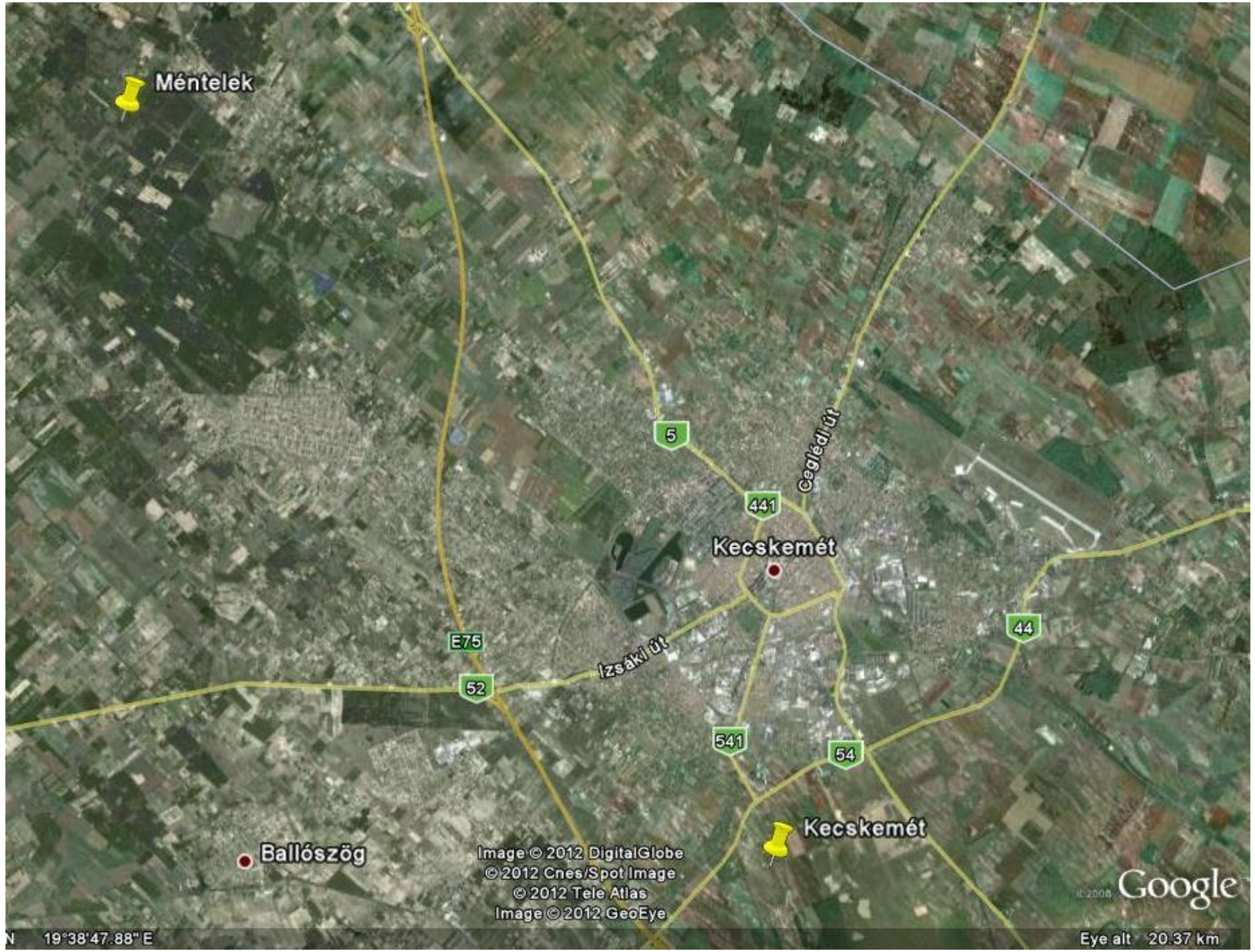
$T_{1/2}$ = 12.32 years

^3H (tritium) decays by β emission to ^3He (conservative stable isotope)

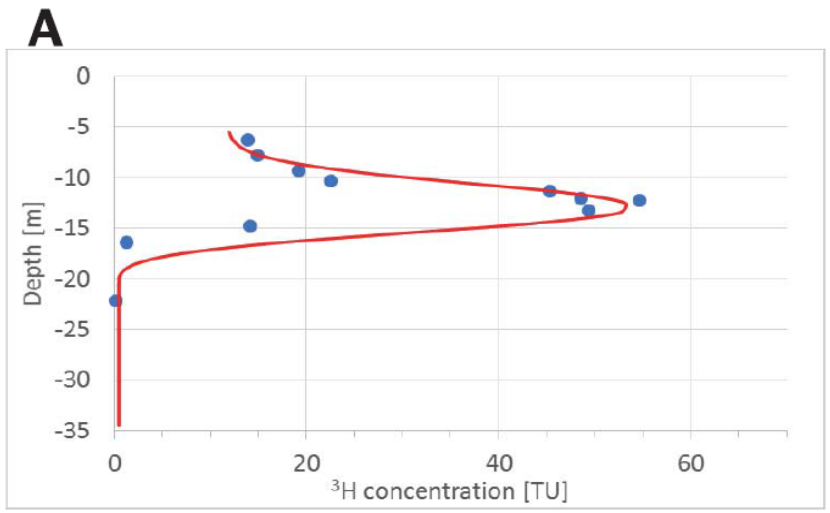
Dating with tritium (^3H)

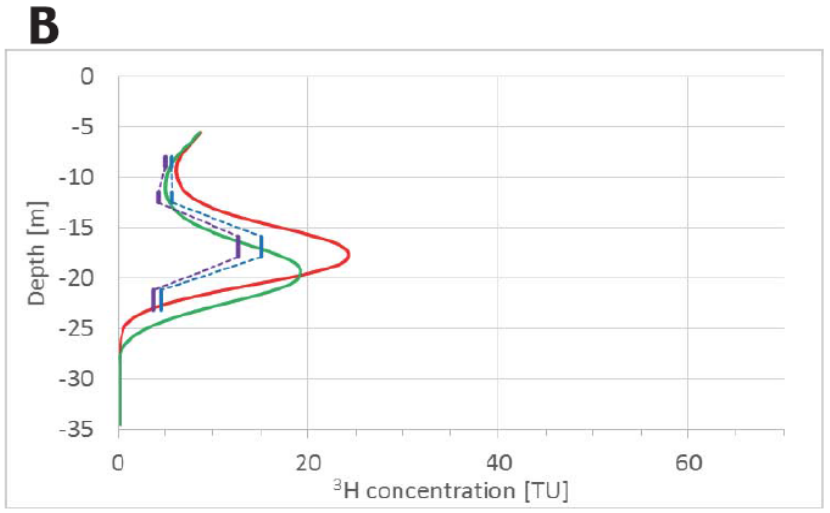


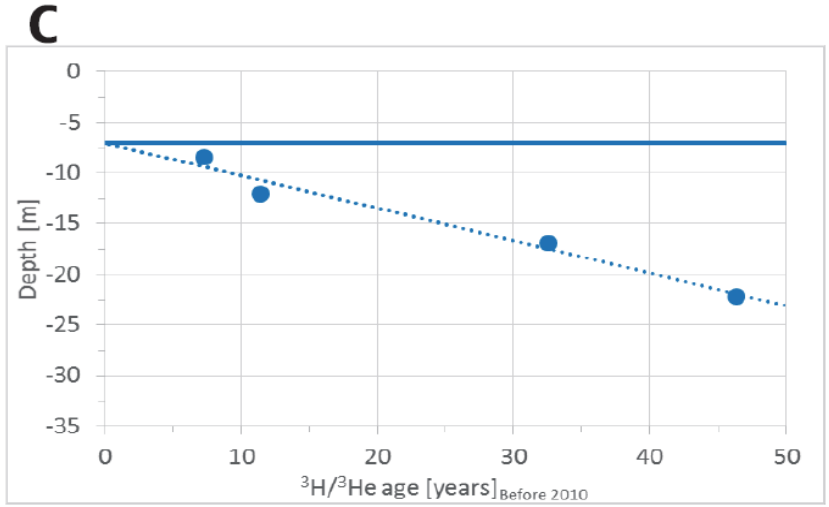
The initial tritium concentration is usually NOT known!

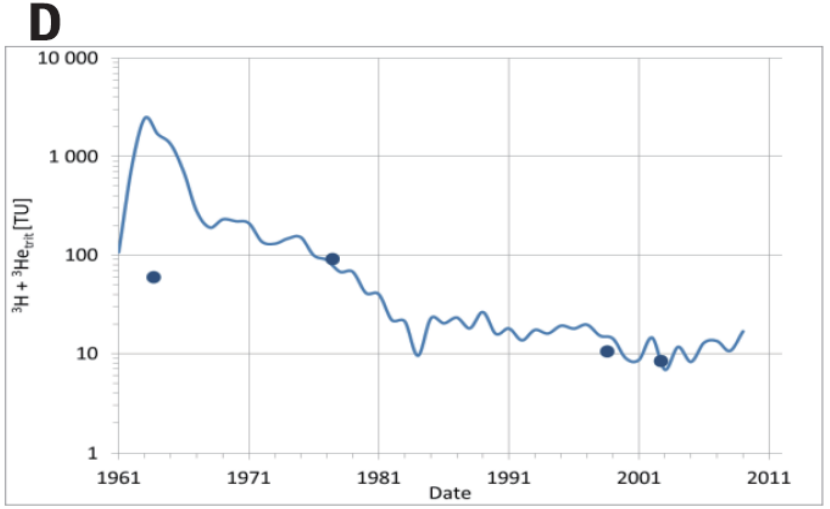

Méntelek
5
441
Cegléd i út
Kecskemét
E75
52
Izsáki út
44
541
54
Kecskemét
Ballószög
Image © 2012 DigitalGlobe
© 2012 Cnes/Spot Image
© 2012 Tele Atlas
Image © 2012 GeoEye
Google
19°38'47.88" E
Eye alt 20.37 km

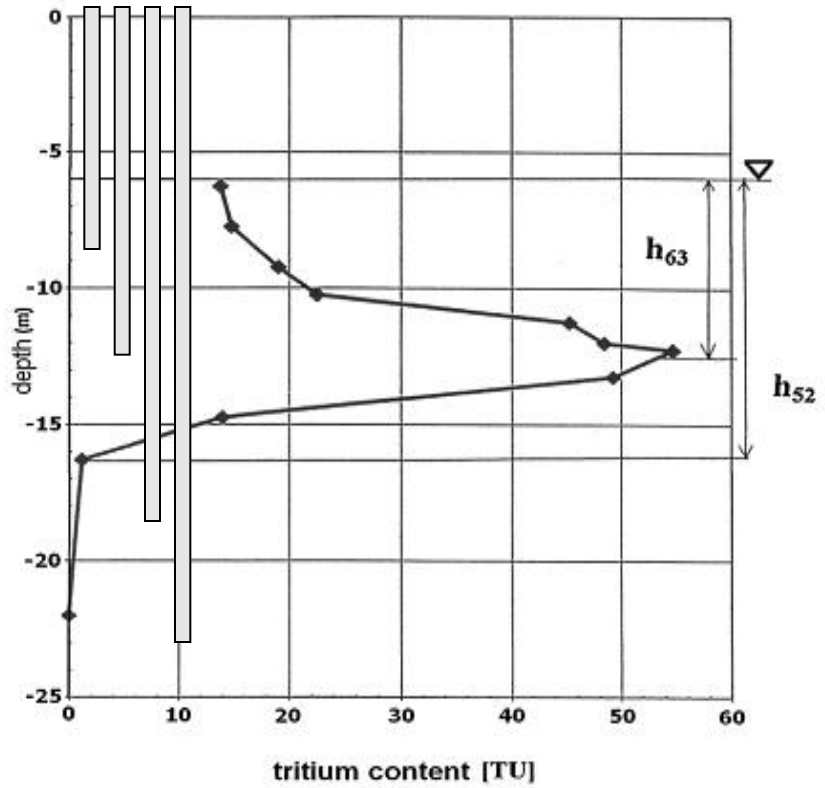
Ménteleki (K-puszta) tanulmányterület ($^3H/^3He$ korolás)









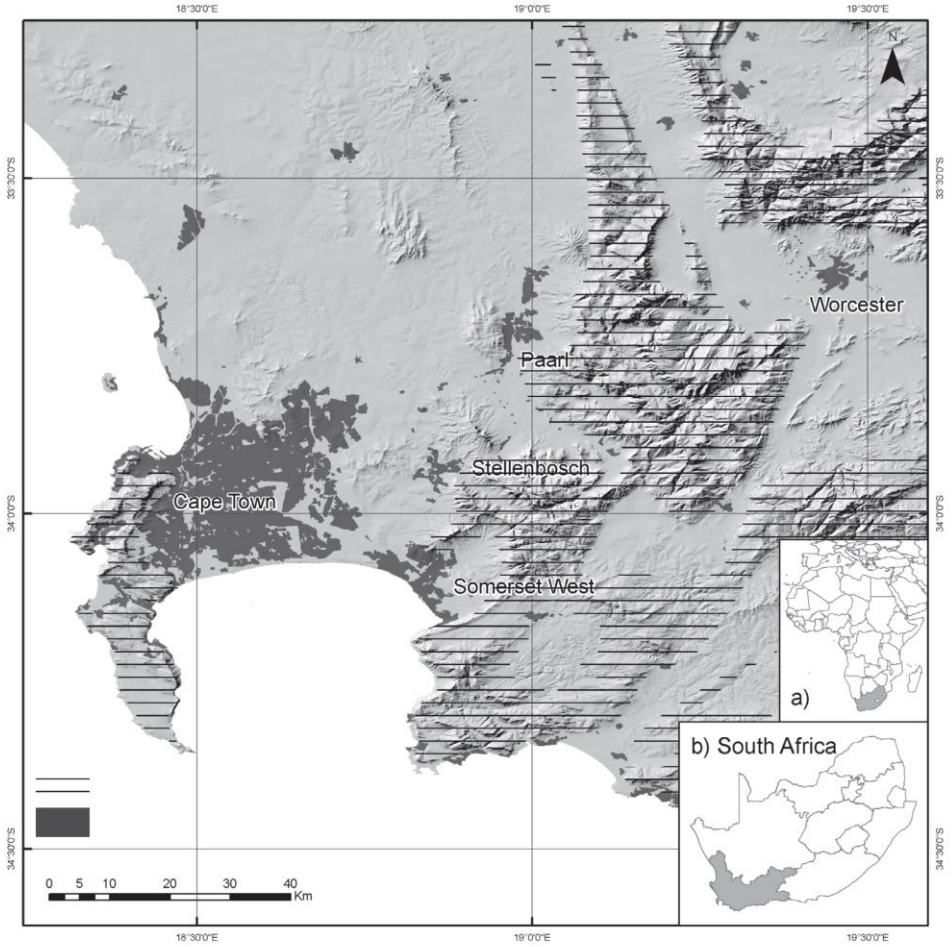


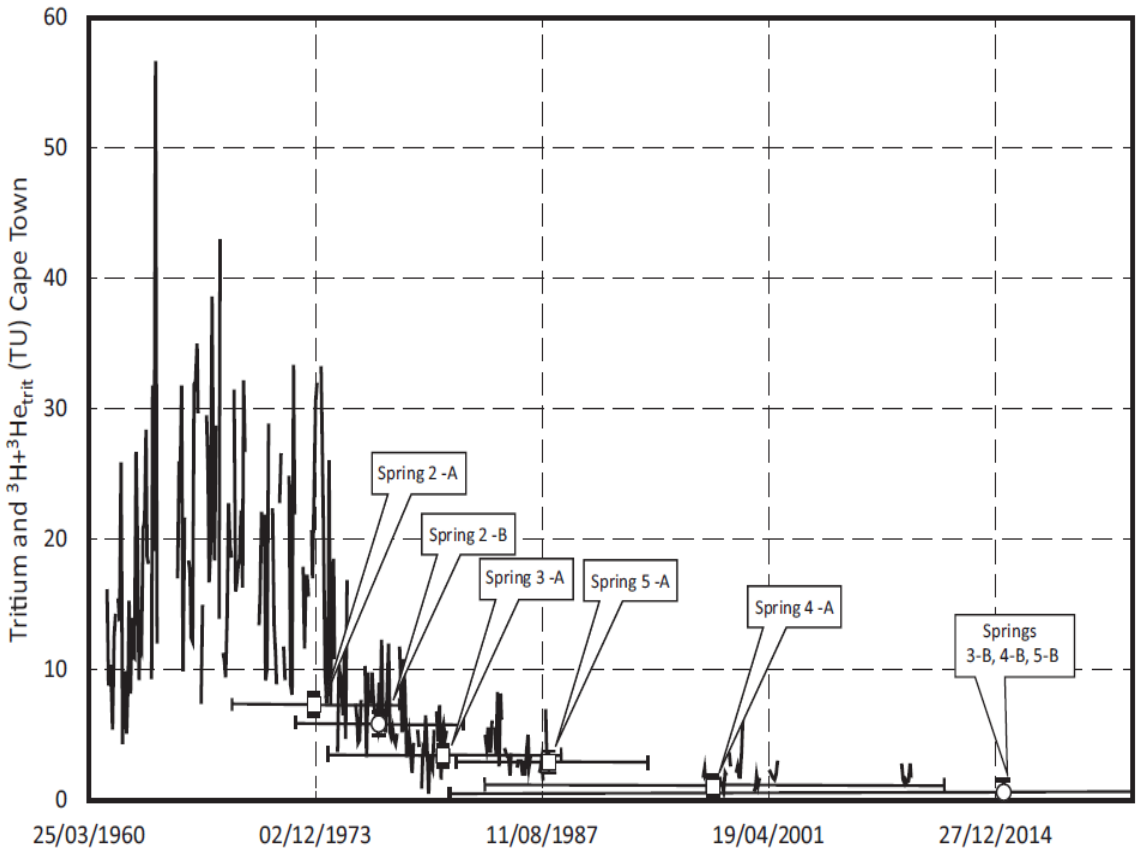
Geochemical Journal, Vol. 51, pp. 439 to 448, 2017 doi:10.2343/geochemj.2.0481

Estimation of the natural groundwater recharge using tritium-peak and tritium/helium-3 dating techniques in Hungary

LÁSZLÓ PALCSU,[1]* LÁSZLÓ KOMPÁR,[2,3] JÓZSEF DEÁK,[4] PÉTER SZŰCS[2,5] and LÁSZLÓ PAPP[1]

Dél-afrikai tanulmányterület ($^3H/^3He$ korolás)



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journal homepage: www.elsevier.com/locate/jhydrol

esearch papers

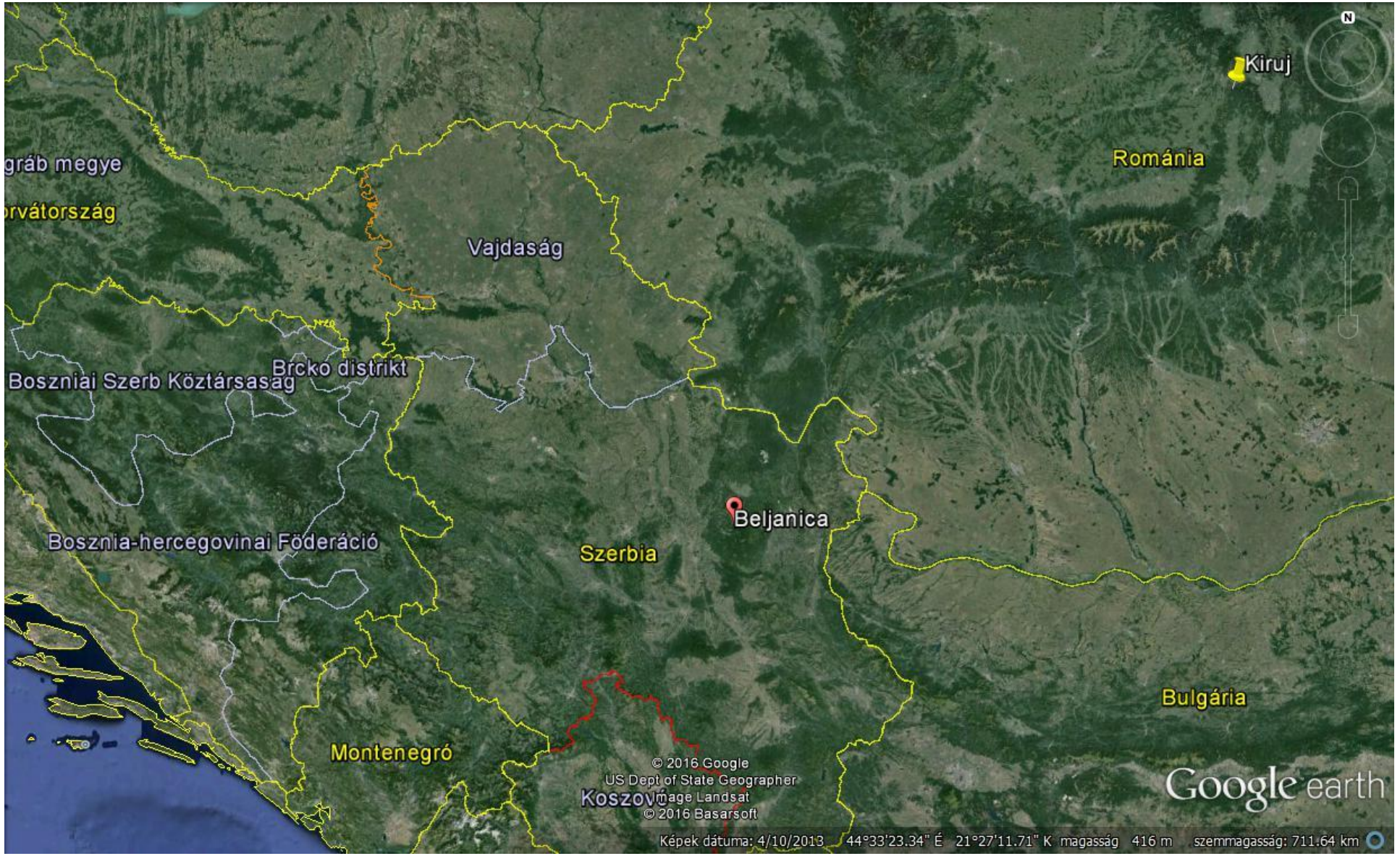
table isotope and noble gas constraints on the source and residence ime of spring water from the Table Mountain Group Aquifer, Paarl, outh Africa and implications for large scale abstraction

A. Miller[a,*], A.I. Dunford[a], K.A. Swana[a], L. Palcsu[b], M. Butler[c], C.E. Clarke[d]

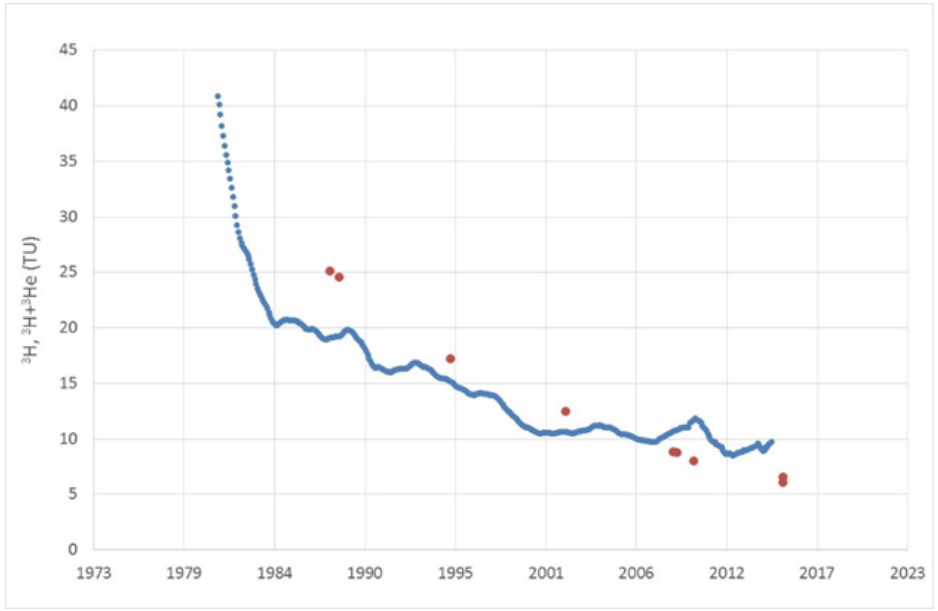
Outline:

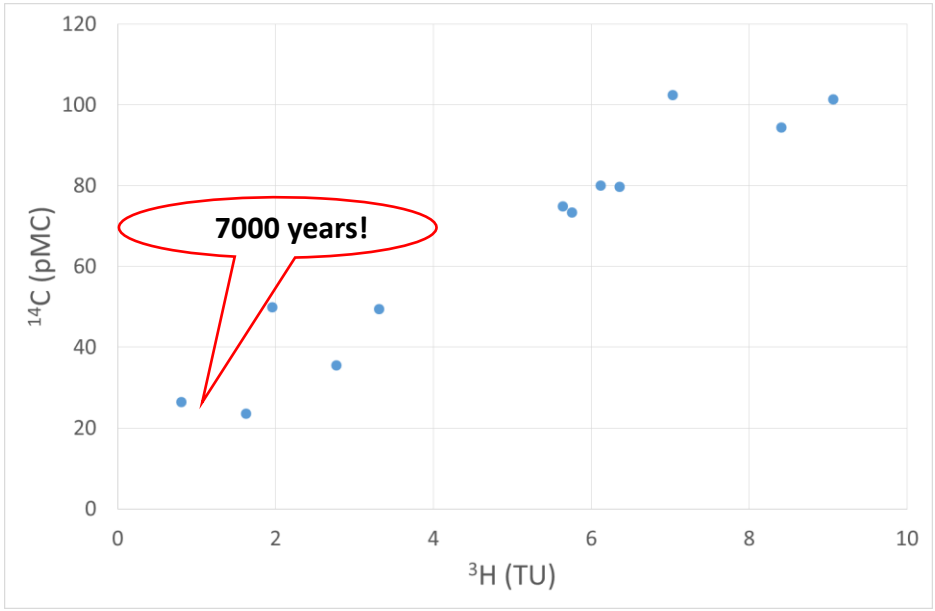
- **Karsthydrology**
- **Water age determination**
- **Case studies (Jasov Plateau, Slovakia, Mecsek Mts., Hungary, Beljanica-Kucaj Karst, Serbia)**
- **^{39}Ar dating (sampling, argon separation, activity detection)**

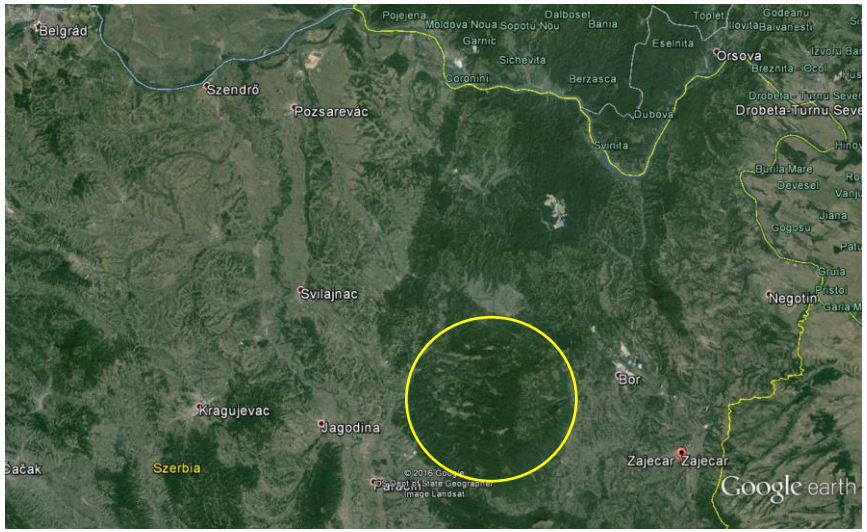
Beljanica-Kucaj Karst, Serbia

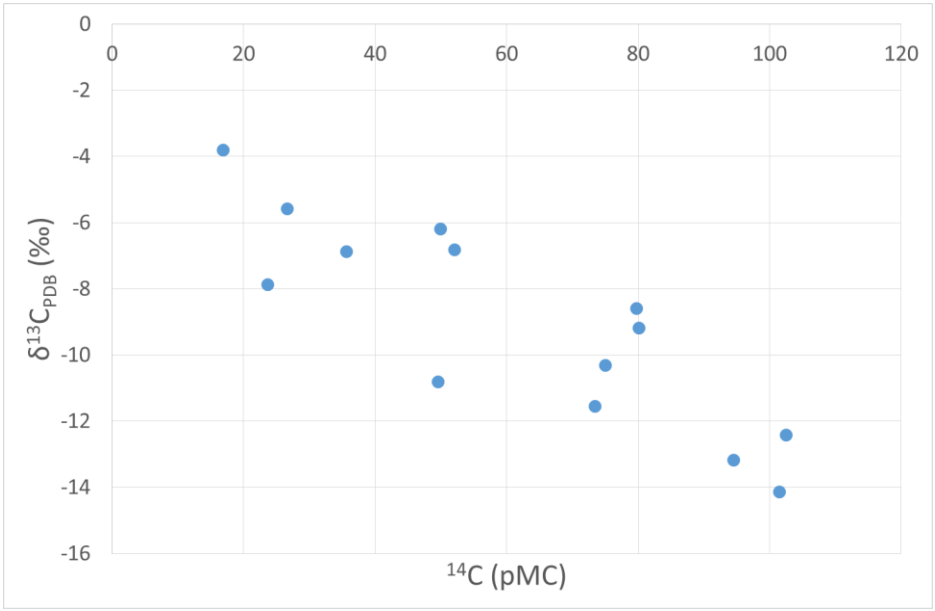


Eredmények (Kucaj-Beljanica Karst)

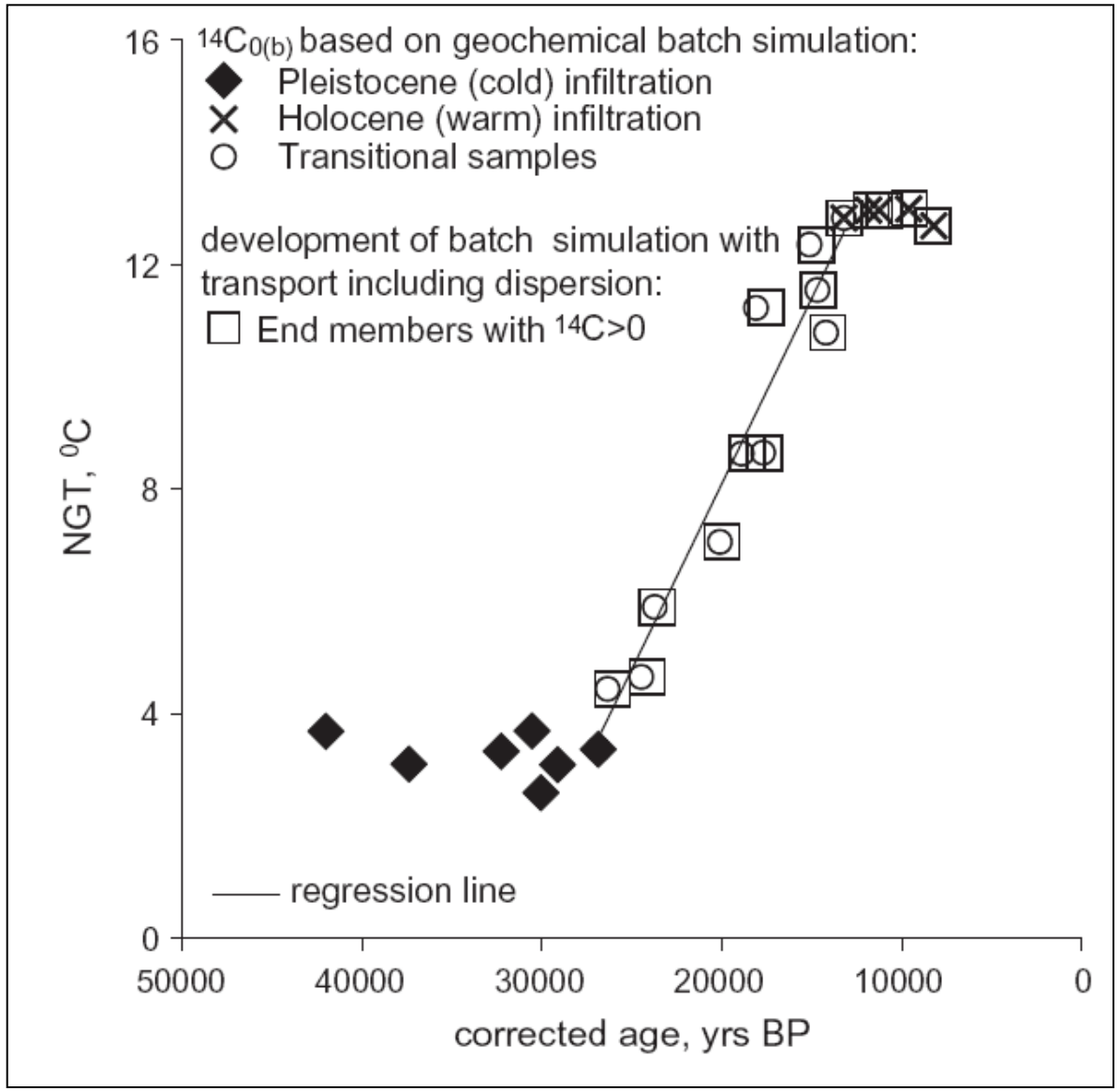


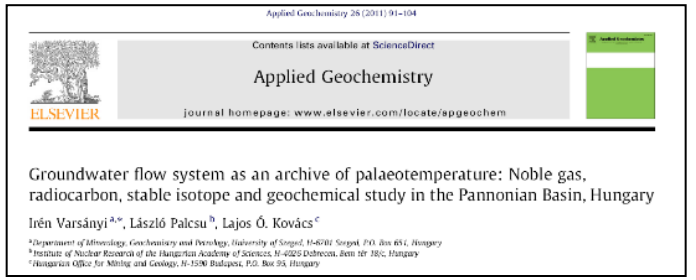






Paleoklíma rekonstrukció: Dél-Alföld




Applied Geochemistry 26 (2011) 91–104

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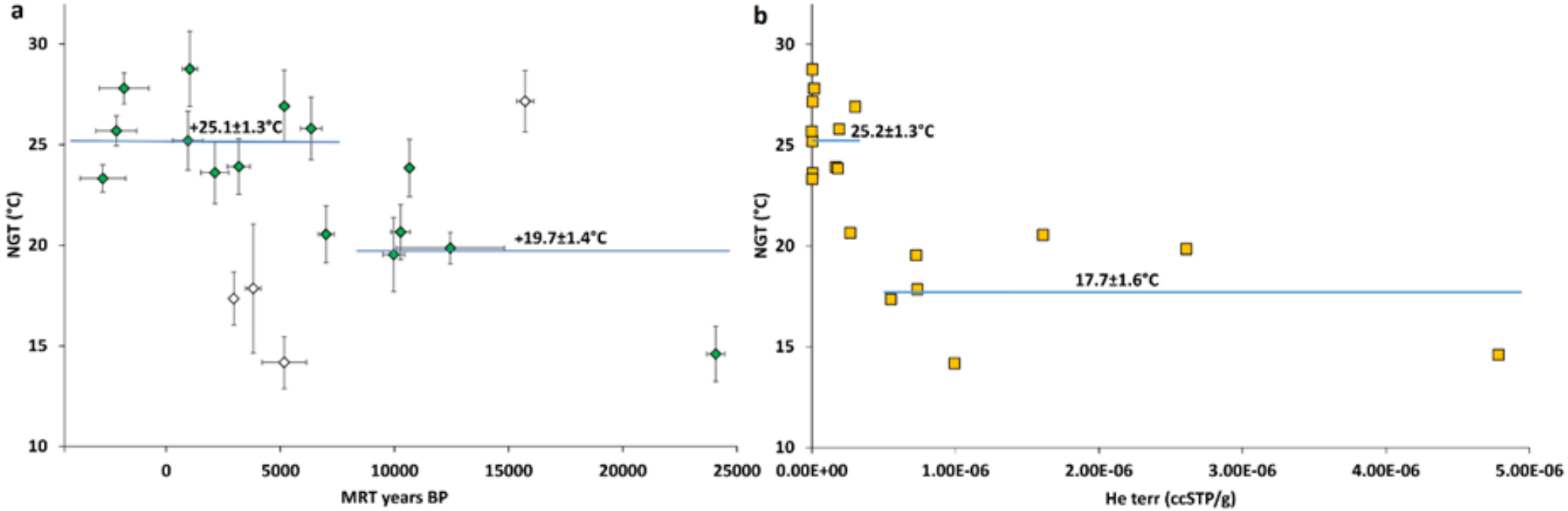
Applied Geochemistry

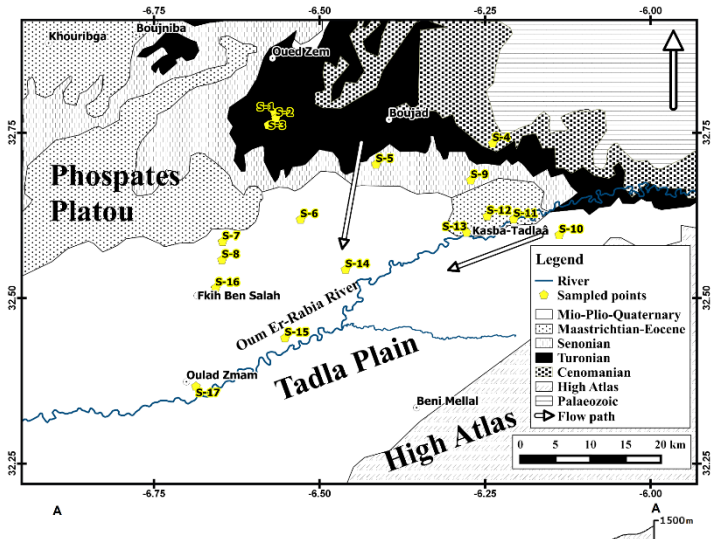
journal homepage: www.elsevier.com/locate/apgeochem

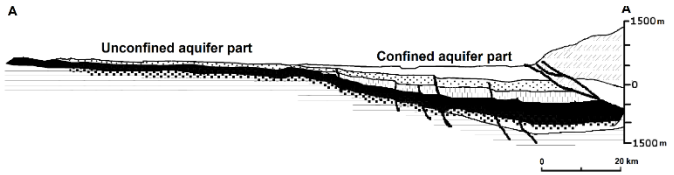
Groundwater flow system as an archive of palaeotemperature: Noble gas, radiocarbon, stable isotope and geochemical study in the Pannonian Basin, Hungary

Irén Varsányi[a,*], László Palcsu[b], Lajos Ó. Kovács[c]

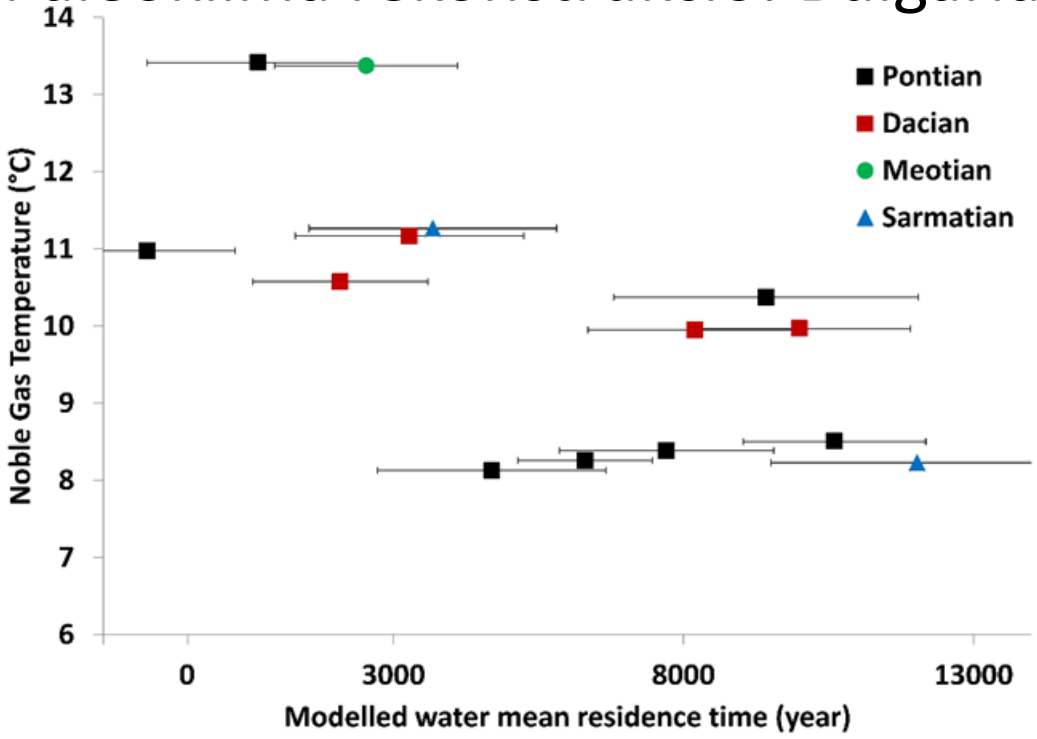
Paleoklíma rekonstrukció: Marokkó

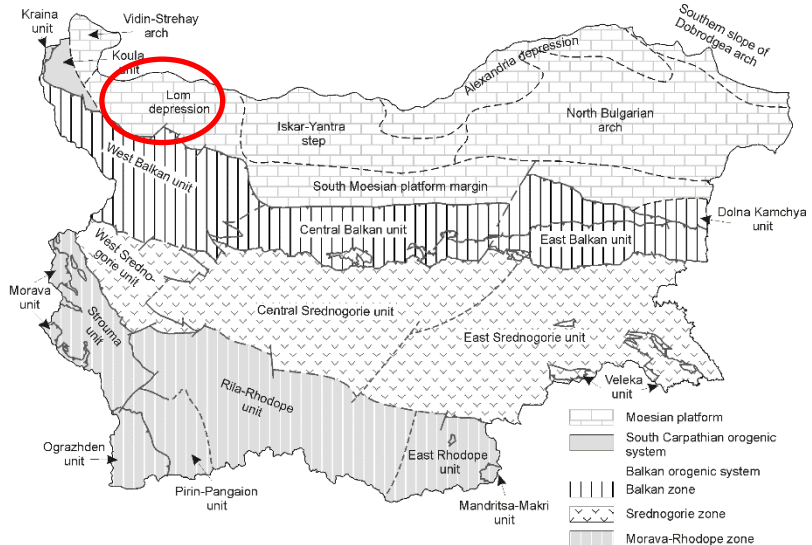


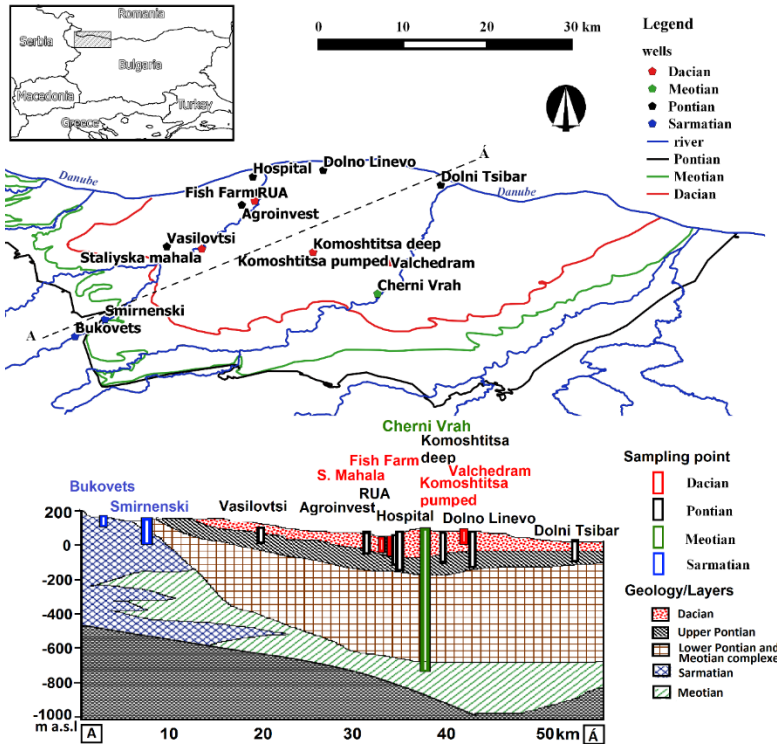




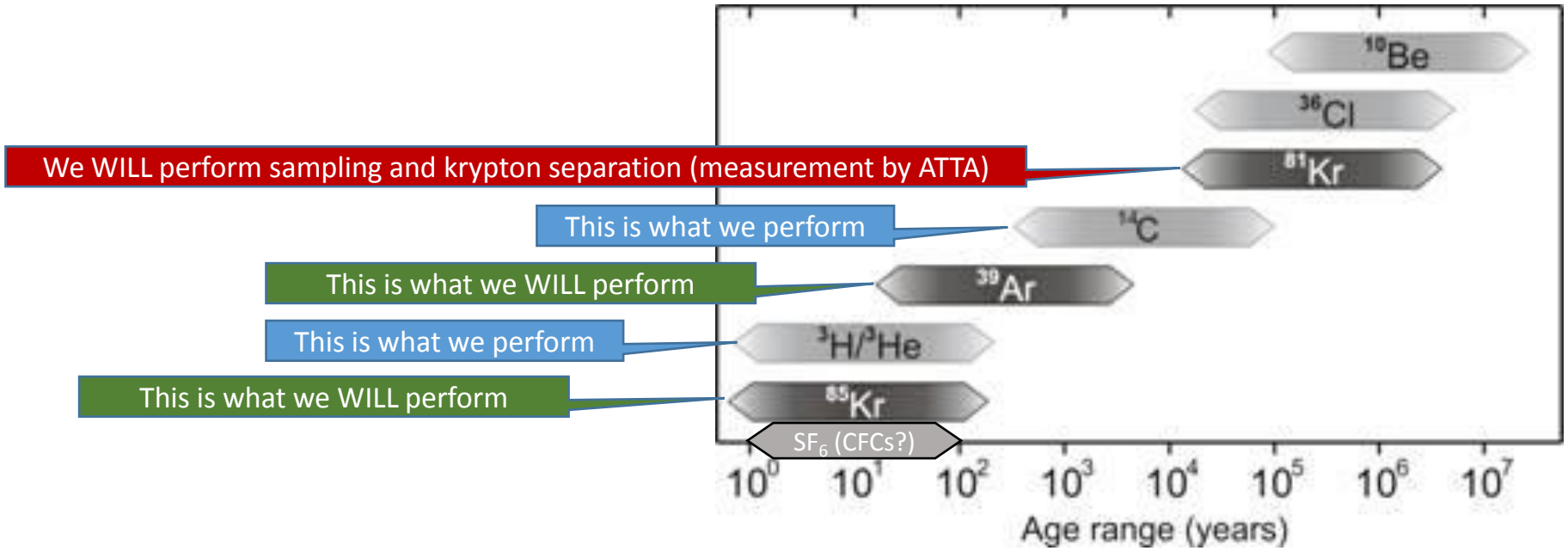
Paleoklíma rekonstrukció: Bulgária

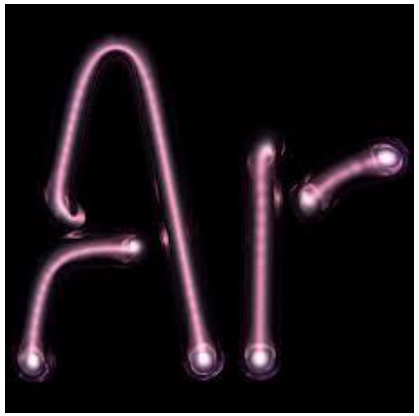






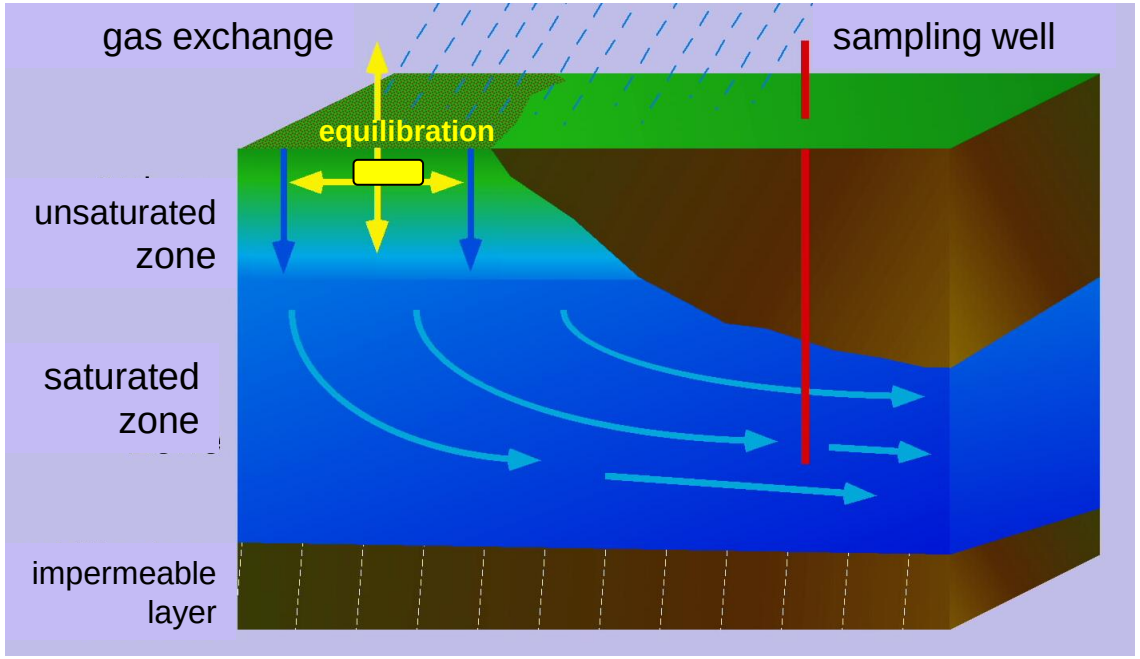
Vízkor-meghatározási módszerek





^{39}Ar (argon-39):

- Tisztán béta-bomló
- Felezési idő: 269 év (±3)
- Kozmogén izotóp (^{40}Ar (n,2n)^{39}Ar)
- Aktivitáskoncentráció: ~0,0015 Bq/liter$_{Ar}$
- ^{39}Ar/Ar ~ 10^{-16}



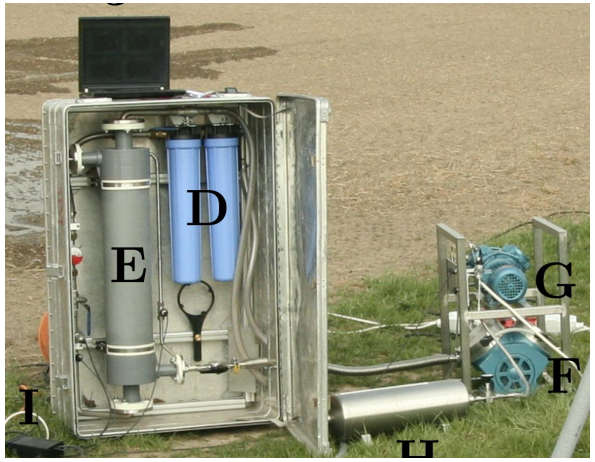
Mintázás a terepen:

100 liter oldott gázt kell kinyerni a vízből

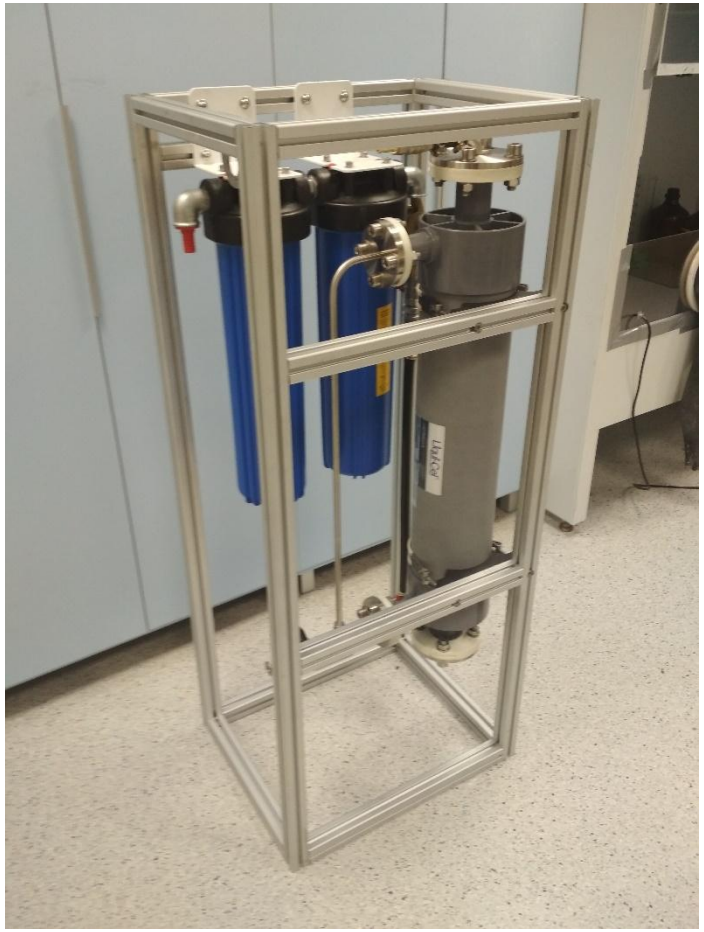
^{39}Ar and ^{85}Kr dating of water: sampling in the field:

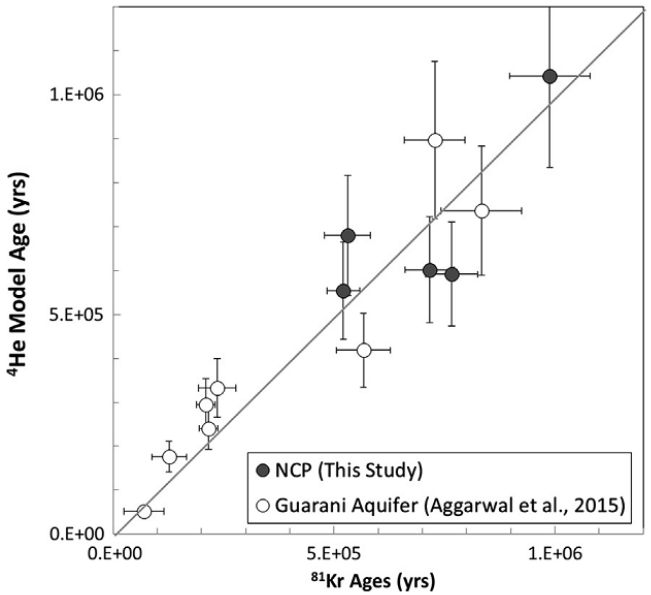
The aim is to extract at least 100 litres dissolved gas from the water

(and sampling for ^{81}Kr)



Thomas Reichel PhD dissertation





Argon (and krypton) separation: 1 litre of Ar (99.99% purity)!

And

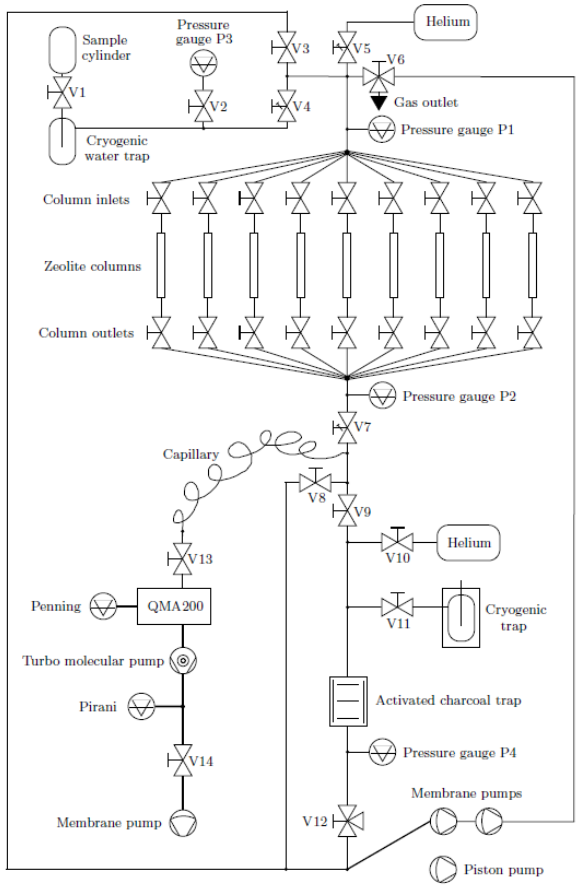
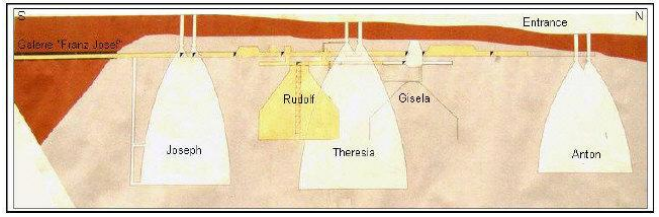


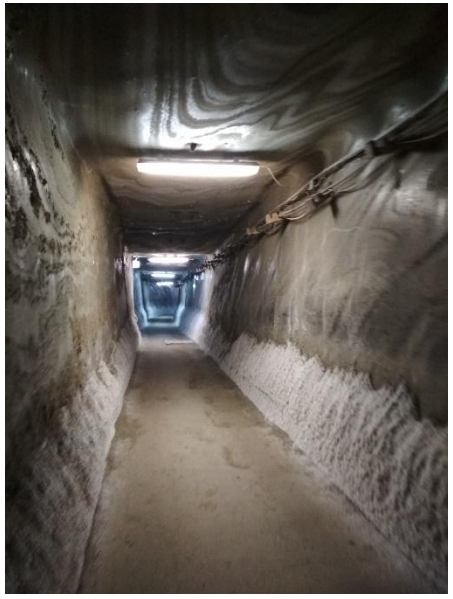
Figure 4.1: A schematic of the setup for argon separation.

Thomas Reichel PhD dissertation

^{39}Ar and ^{85}Kr detection: low background proportional counting tubes in an underground laboratory

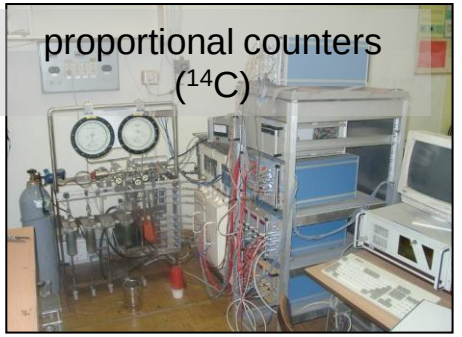
Potential site: Salt mine, Turda, Romania

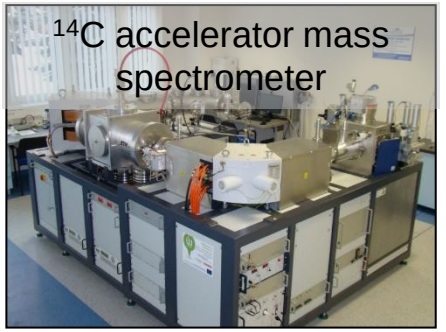




Isotope Climatology and Environmental Research Centre

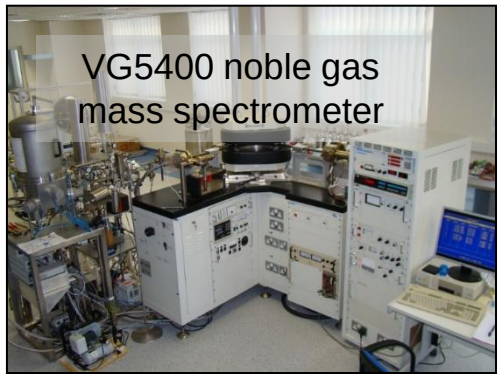
- 32 people (8 senior researchers, 8 associate researchers, 8 early-stage researchers, 8 technicians)
- Archaeological chronology (^{14}C dating) (bone, tree, charcoal, peat, etc.)
- Geochronology (K/Ar, Ar/Ar dating) (volcanic, magmatic rocks and minerals)
- Stable isotope geochemistry (water cycle, carbonate clumped thermometry, etc.)





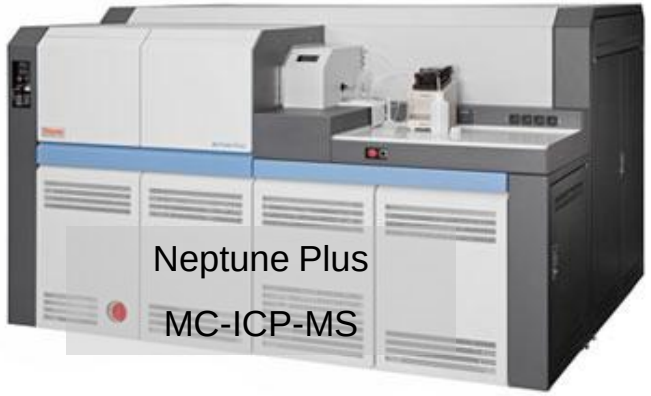
Isotope Climatology and Environmental Research Centre

- Isotope hydrology (^{3}H, $^{3}H/^{3}He$ dating, noble gas recharge temperatures)



- Palaeoclimate reconstruction (groundwater, stalagmite, peat bog, lake sediment)

- Environmental geochemistry



Thank you for your attention!

^{39}Ar detection: state-of-the-art techniques

ATTA: atom trap trace analysis