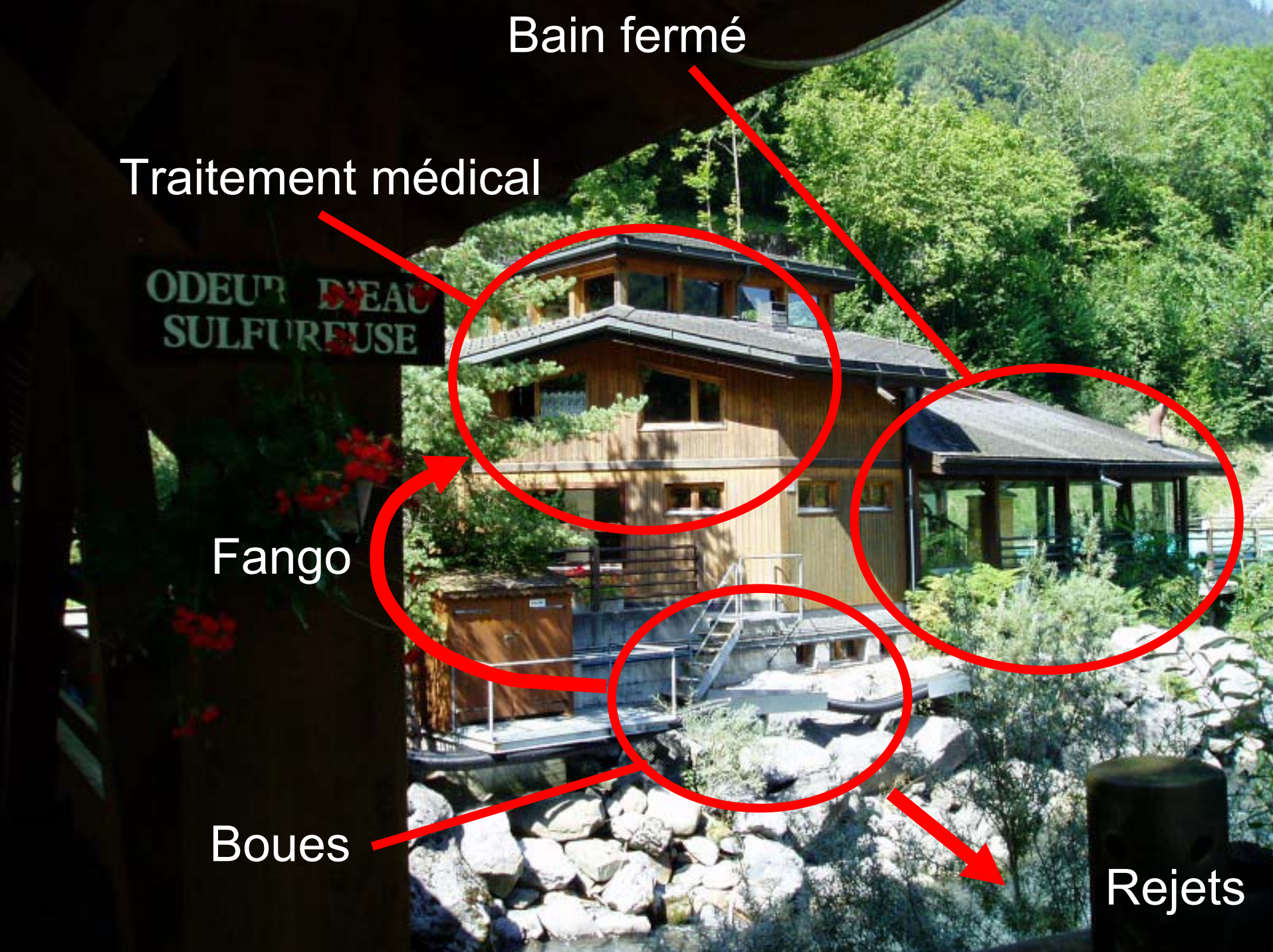
L'éxposition aux rayonnements ionisants dans les établissements thermaux

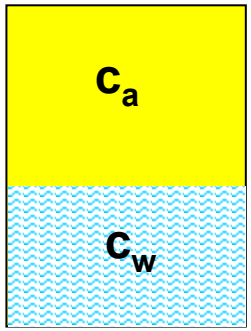
Heinz Surbeck

Centre d'hydrogéologie (CHYN)
Université de Neuchâtel,
Emile-Argand 11
CH-2007 Neuchâtel
Suisse

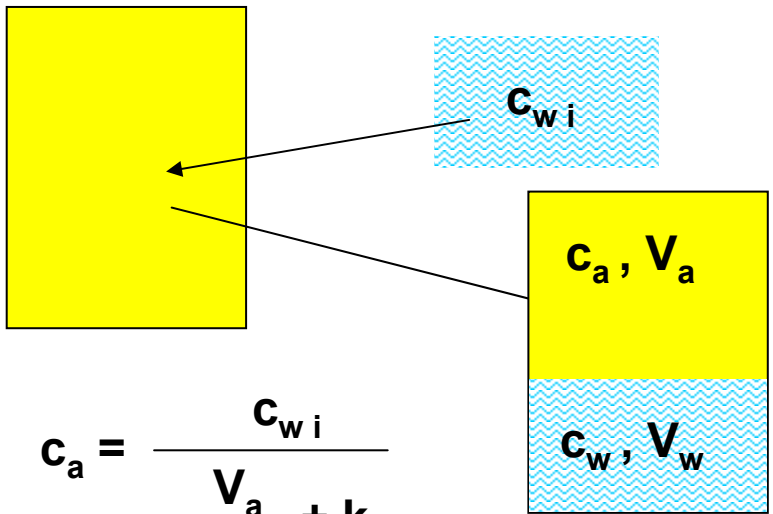

ODEUR D'EAU
SULFUREUSE


Bain fermé
Traitement médical
Fango
Boues
Rejets

Radon



$$c_w = k \cdot c_a$$

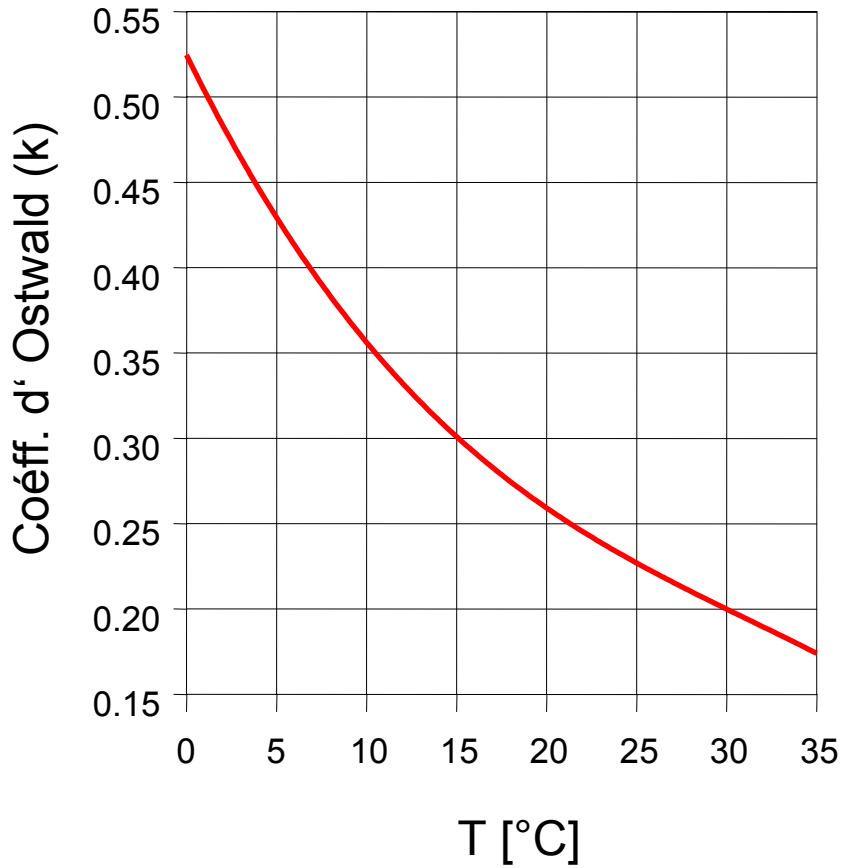


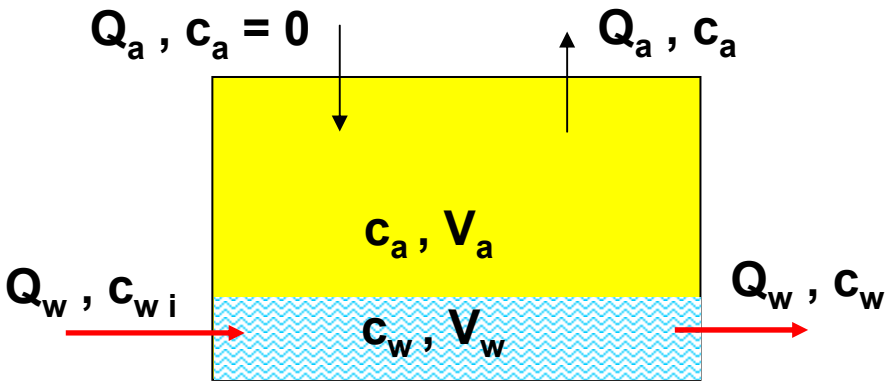
$$c_a = \frac{c_{w\,i}}{\frac{V_a}{V_w} + k}$$

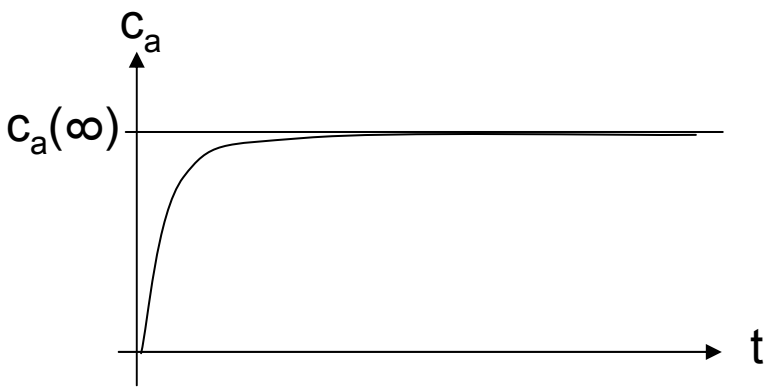
bain : $\frac{V_a}{V_w} \sim 3 >> k$

$$c_a = \frac{c_{w\,i}}{\frac{V_a}{V_w}}$$

~ indépendant de la température

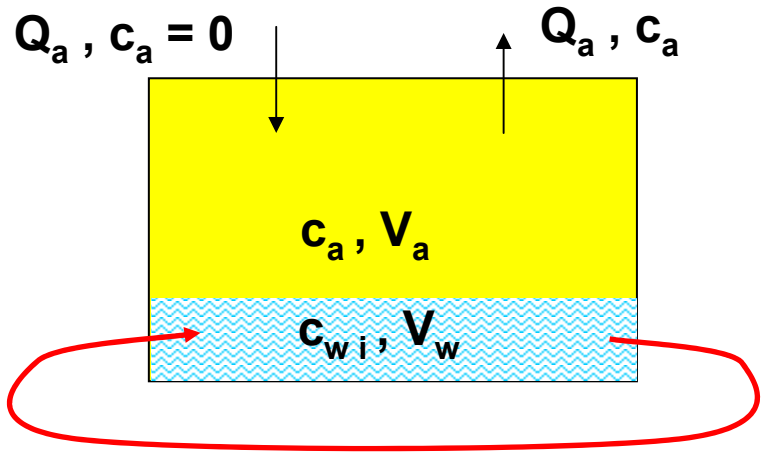


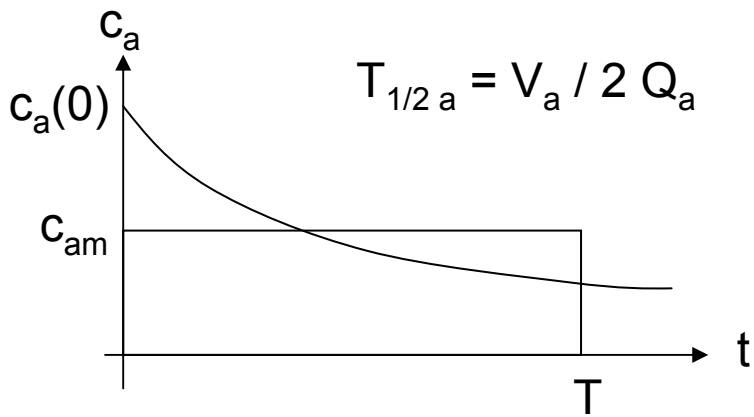




$$c_a = \frac{c_{w\,i}}{\frac{Q_a}{Q_w}}$$

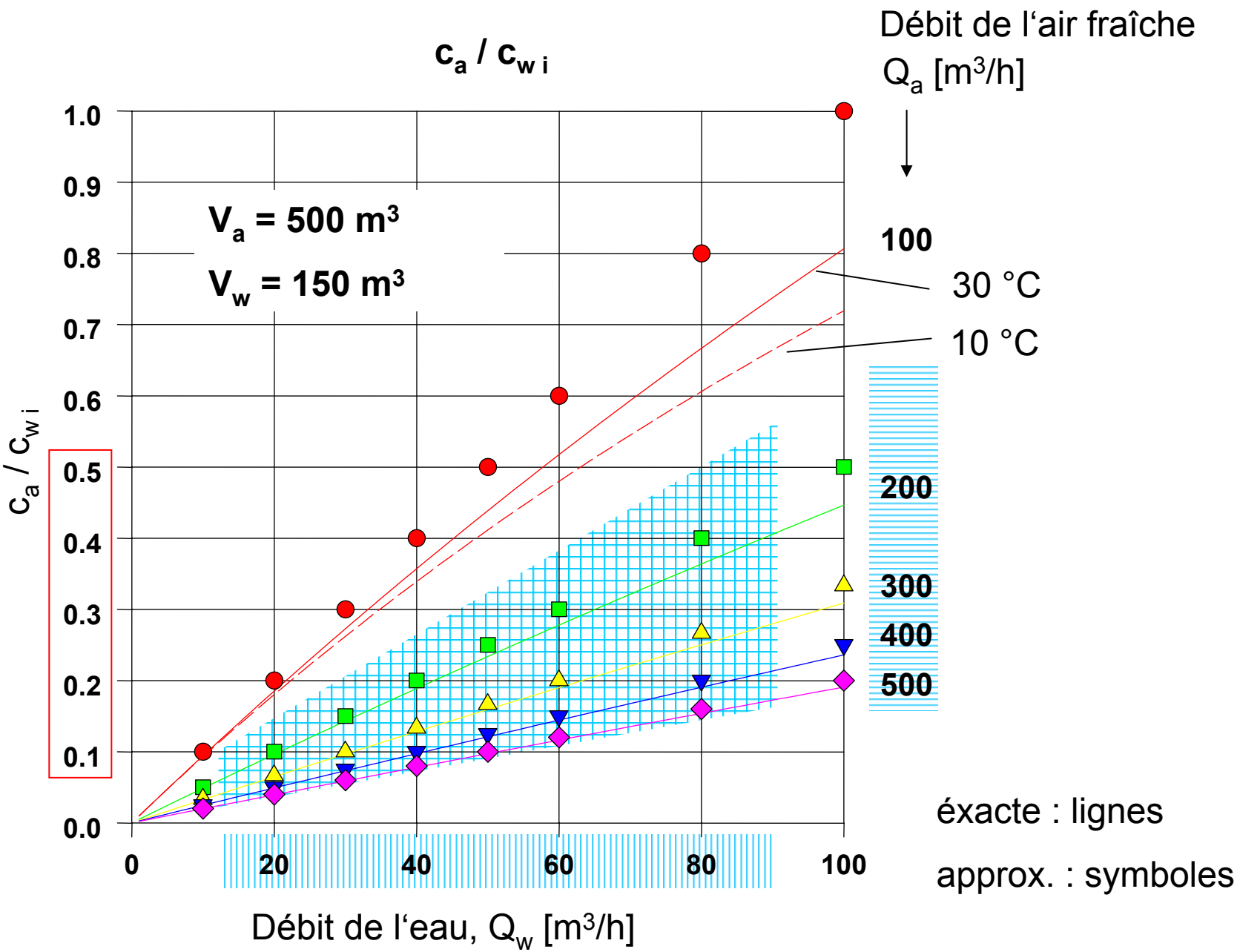
$c_a \sim 0.1 - 0.5\ c_{w\,i}$

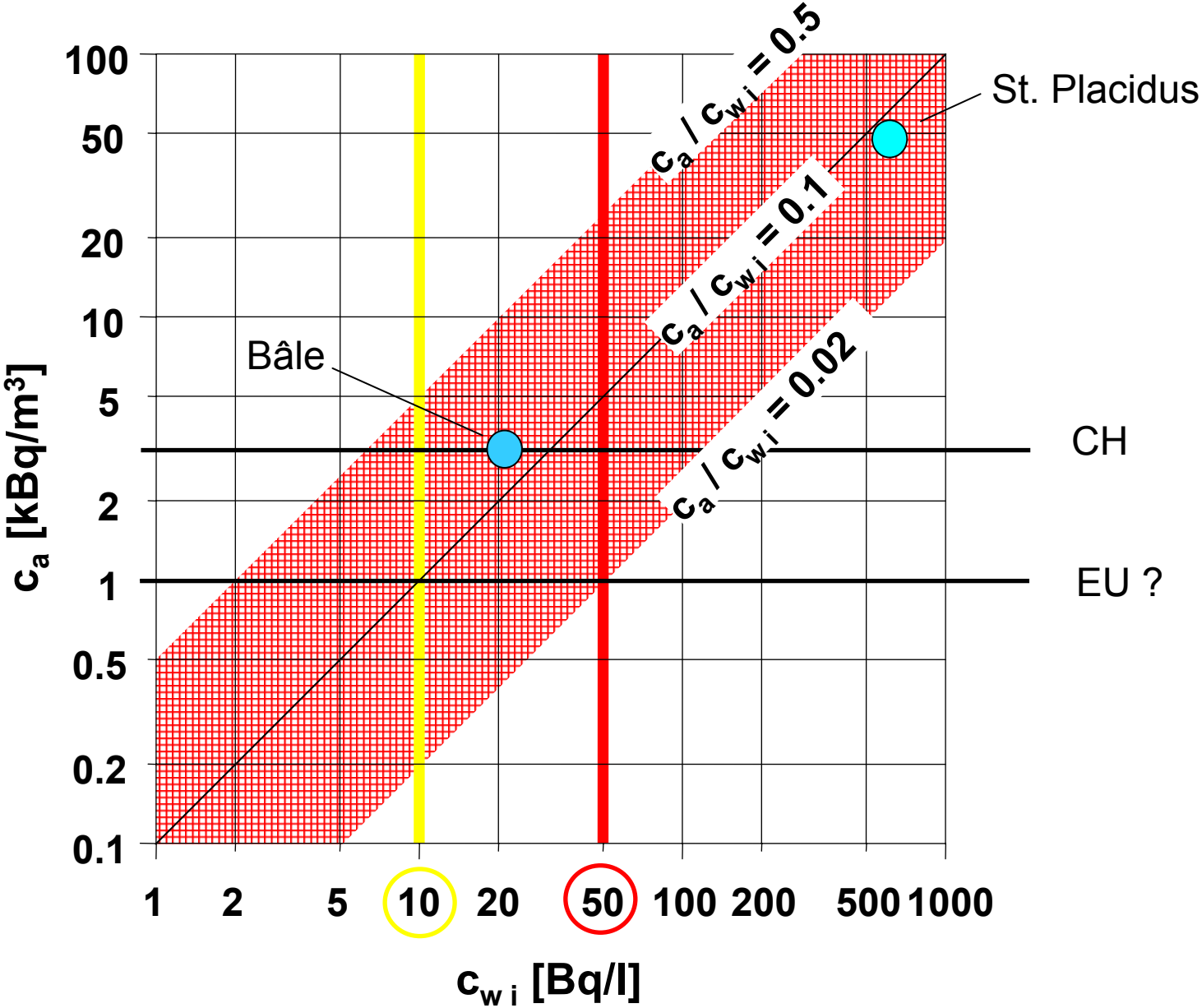




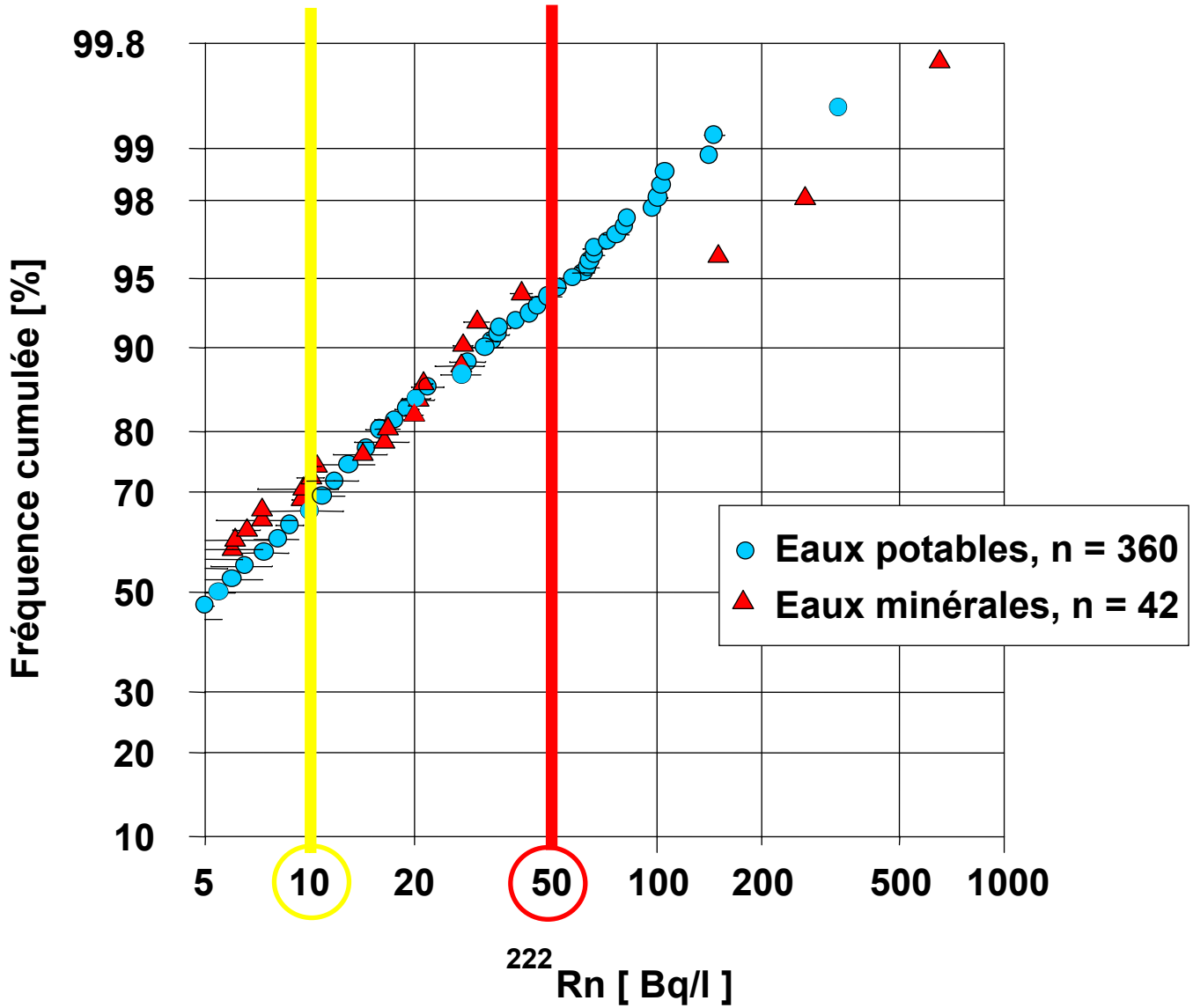
$$c_{am} = \frac{c_{w\,i}}{\frac{V_a}{V_w}} \cdot \frac{T_{1/2\,a}}{\ln 2 \cdot T}$$

$c_{am} \sim 0.02 - 0.1\ c_{w\,i}$


$c_a / c_{w\,i}$
Débit de l'air fraîche
Q_a [m³/h]
V_a = 500 m³
V_w = 150 m³
100
30 °C
10 °C
200
300
400
500
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
0
20
40
60
80
100
$c_a / c_{w\,i}$
Débit de l'eau, Q_w [m³/h]
éxacte : lignes
approx. : symboles


100
50
20
10
5
2
1
0.5
0.2
0.1
c_a [kBq/m^3]
1
2
5
10
20
50
100
200
500
1000
$c_{w\,i}$ [Bq/l]
$c_a / c_{w\,i} = 0.5$
$c_a / c_{w\,i} = 0.1$
$c_a / c_{w\,i} = 0.02$
St. Placidus
Bâle
CH
EU ?

^{222}Rn dans les eaux du Canton des Grisons (Suisse)



Boues

eau de la source

^{226}Ra : 30 mBq/l

^{228}Ra : 180 mBq/l

Fe : 3 mg/l

aération

filtre (sable de quartz)

^{226}Ra : 20 - 25 mBq/l

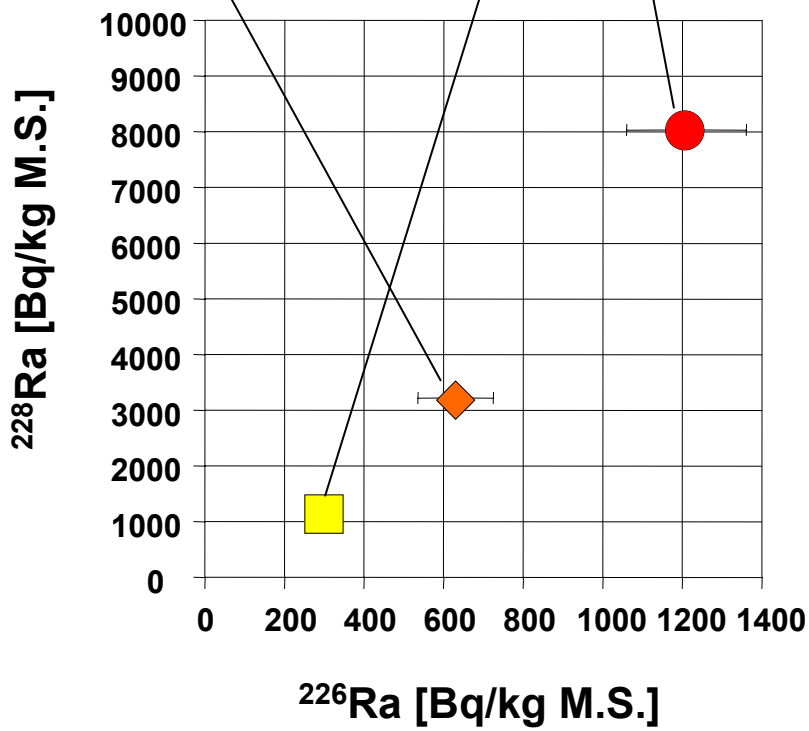
^{228}Ra : 120 - 150 mBq/l

Fe : 0.1 mg/l

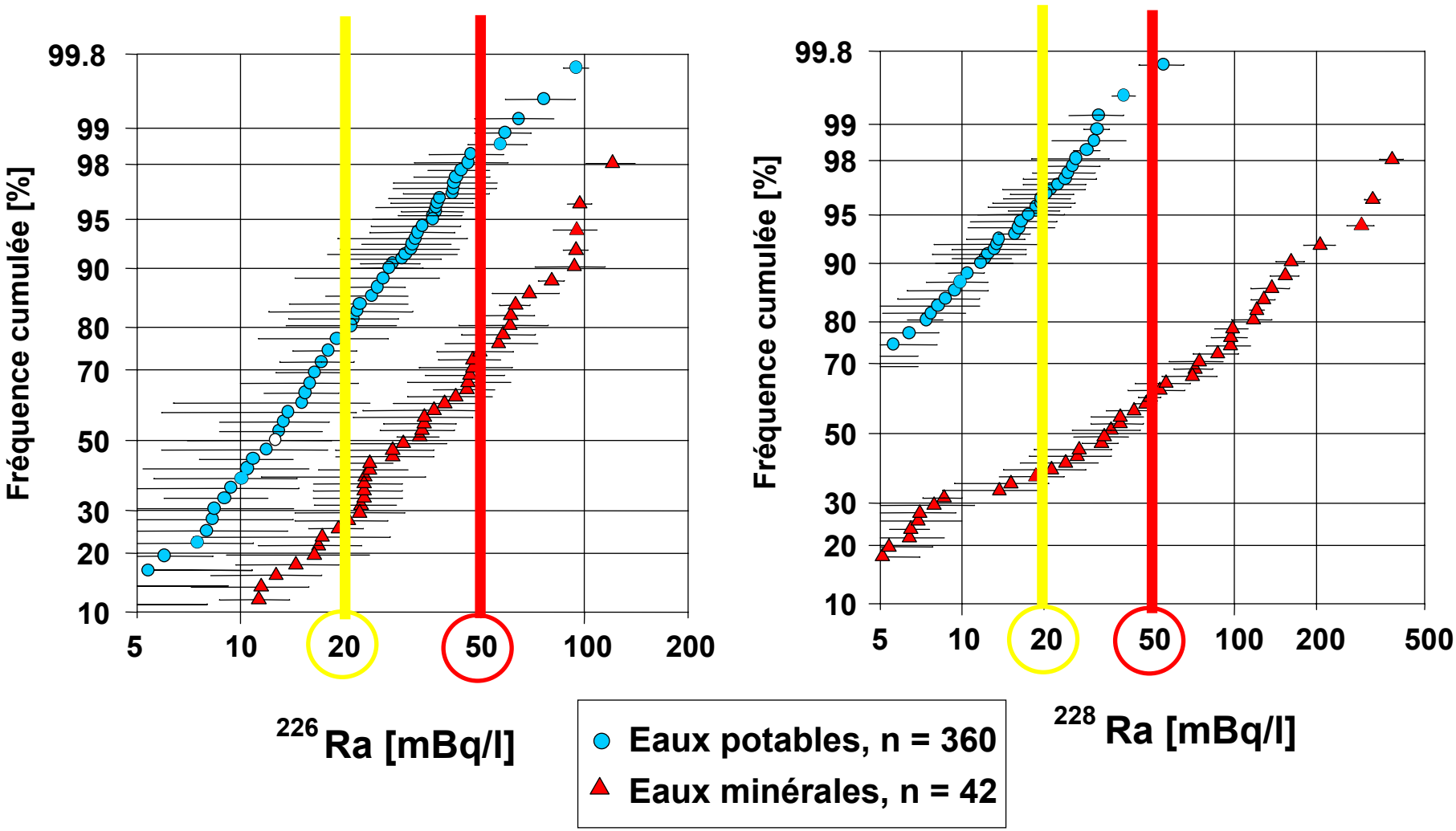
boues dans la conduite

filtre intégral

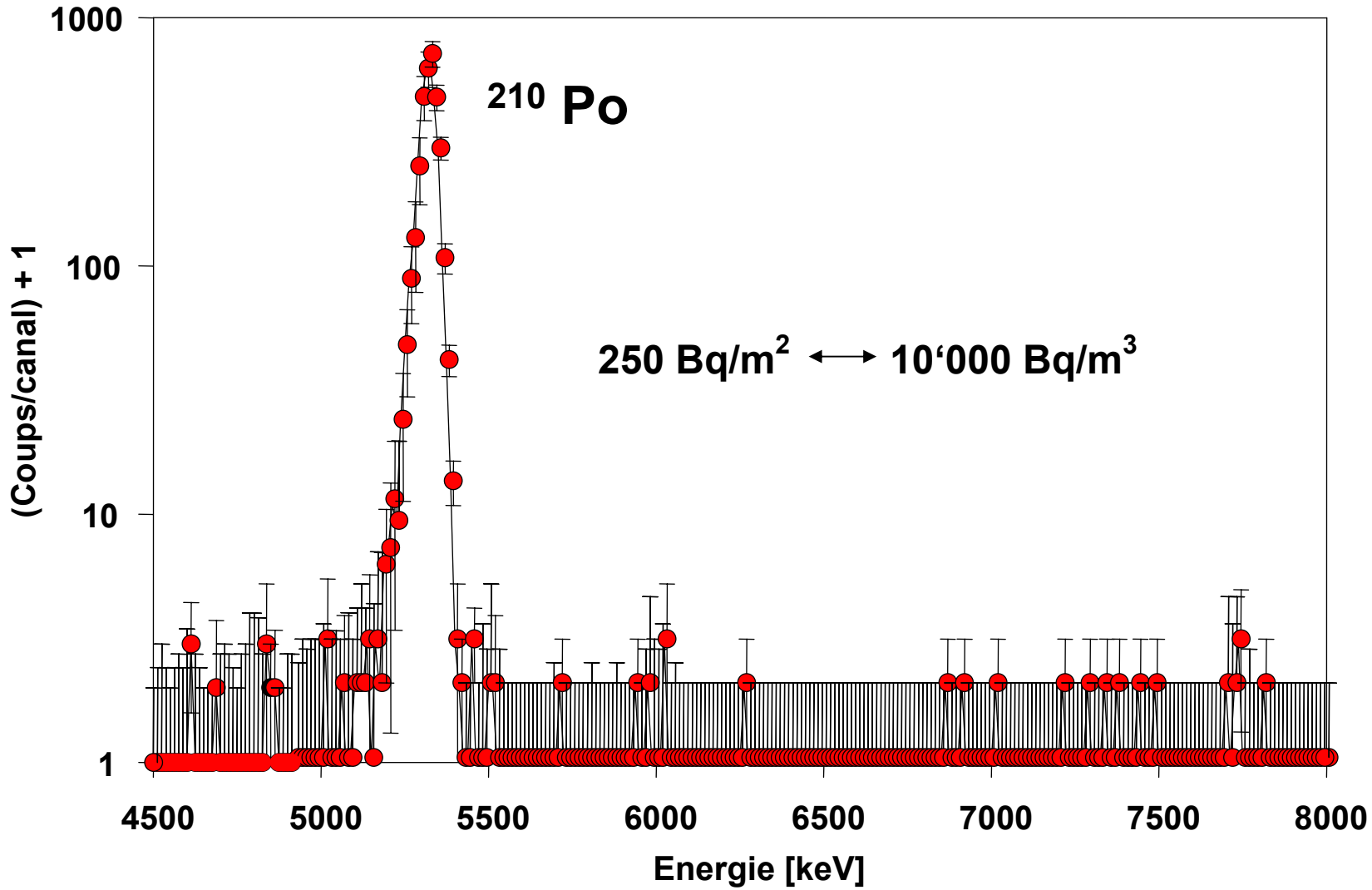
boues



^{226}Ra et ^{228}Ra dans les eaux du Canton des Grisons (Suisse)

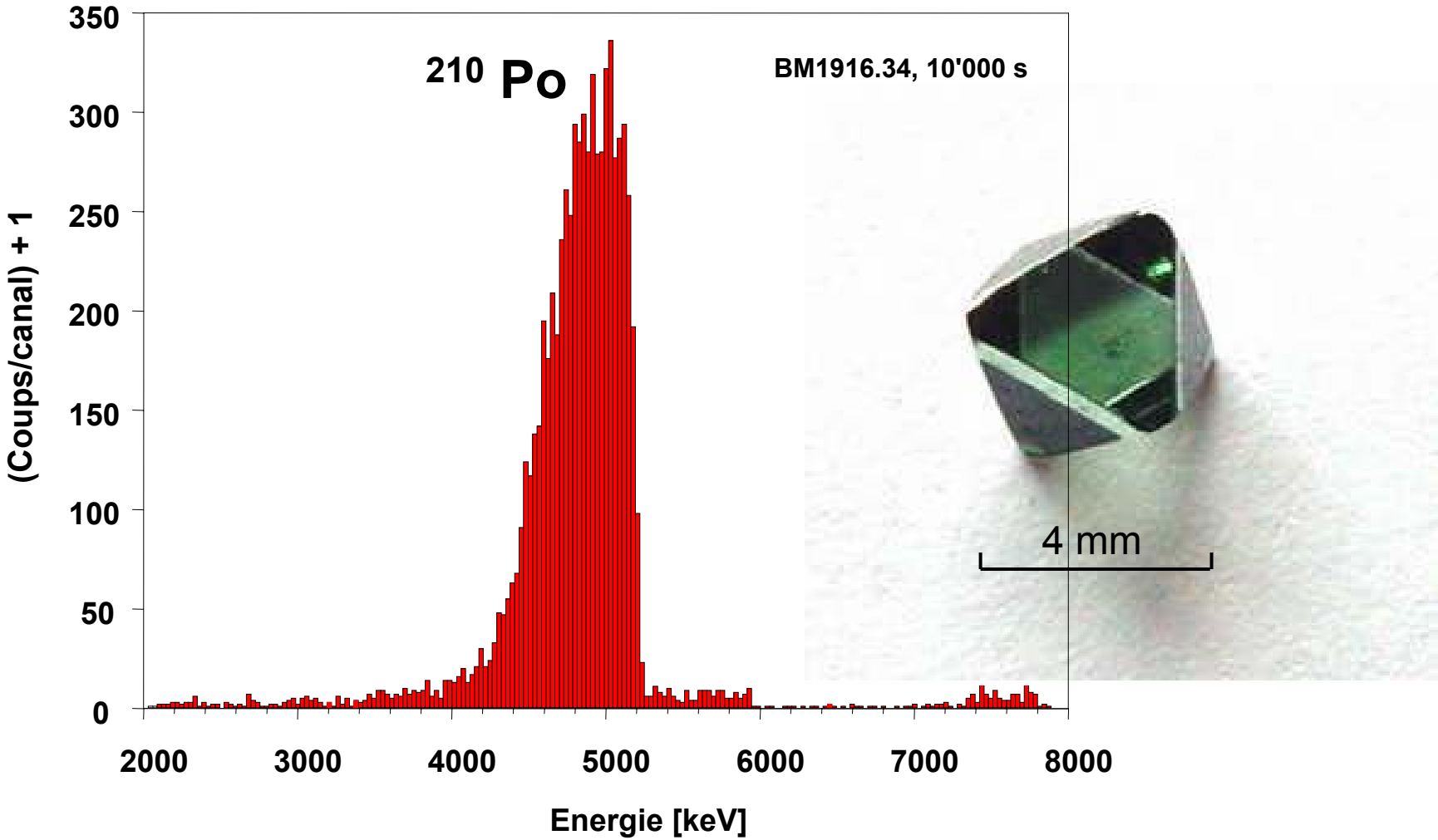


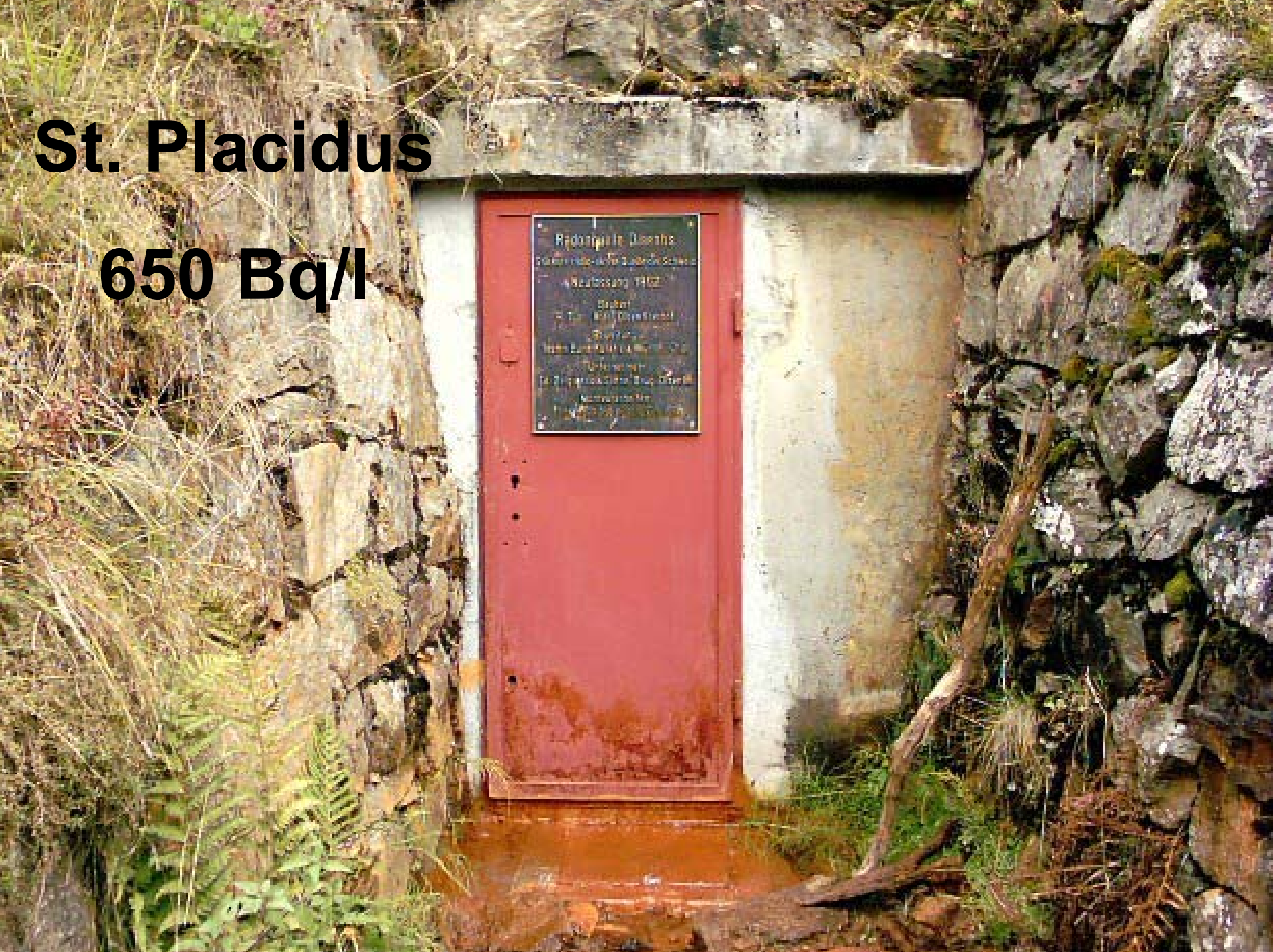
Spectre alpha d'un mirroir éxposé au radon
dans un établissement thermal



Mirroir mis à disposition par Prof. Henning von Philipsborn

Spectre alpha d‘un diamant vert, irradié autour 1910 par Sir William Crookes à l‘aide un sel de radium. Mesuré (dans l‘air) en 2004 au Natural History Museum London par George Bosshart




St. Placidus
650 Bq/l


Frédéric Bossy
François Gainon
Otmar Deflorin