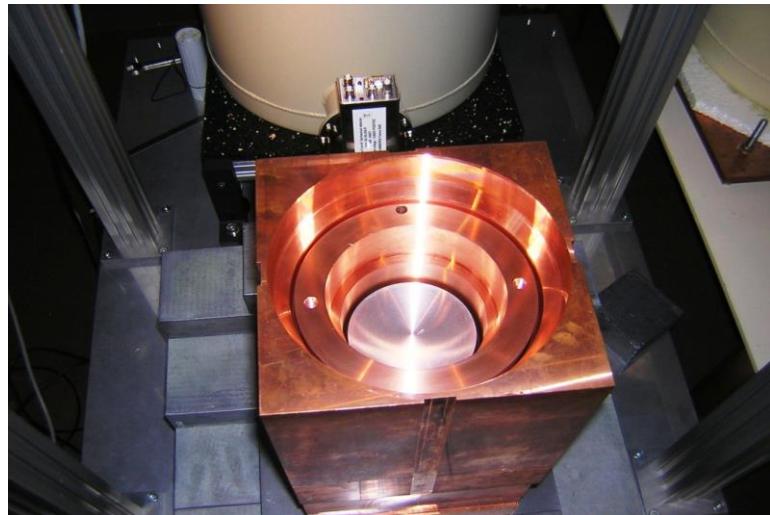


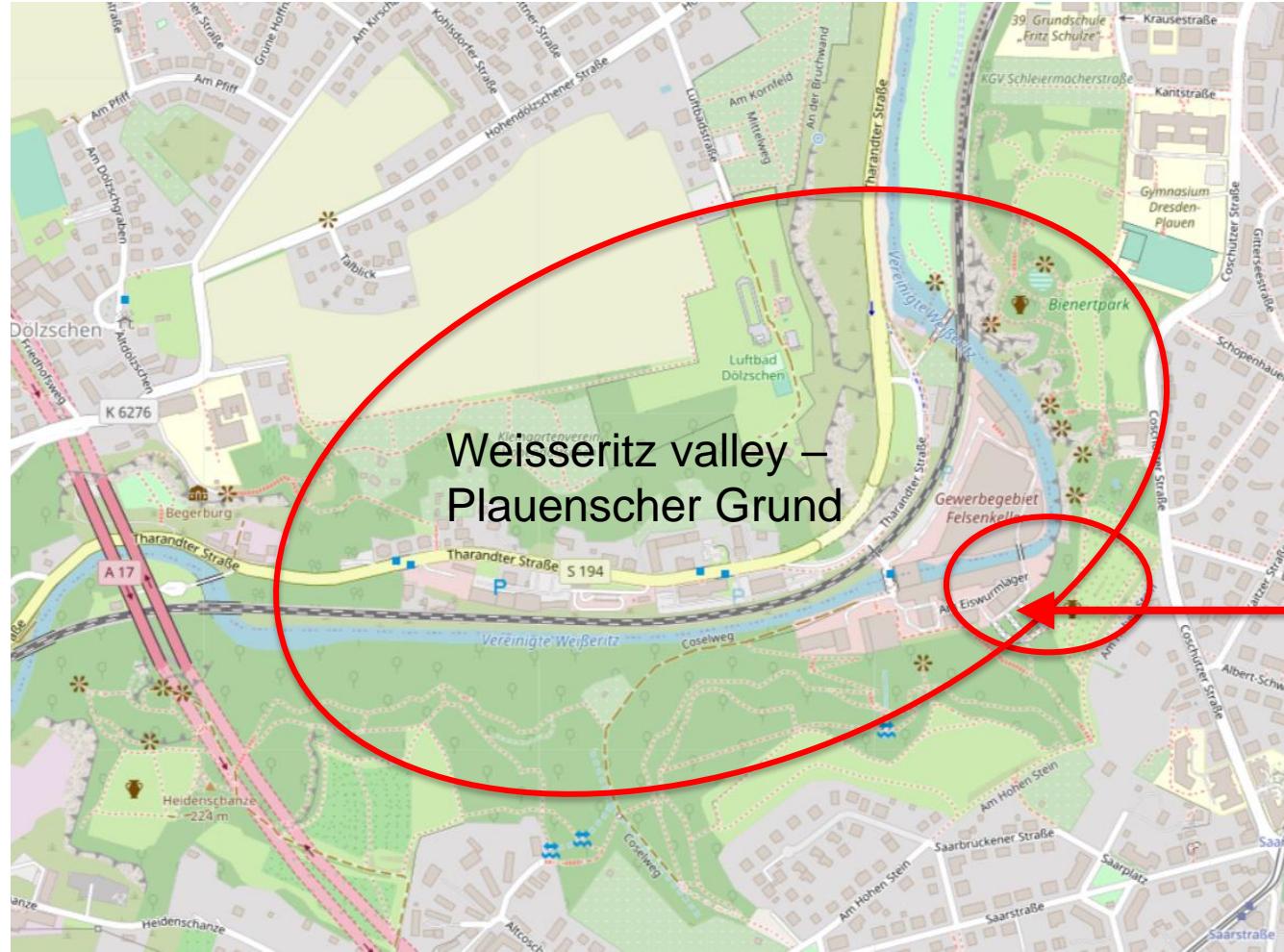
UNDERGROUND LABORATORY FELSENKELLER

1982 – 2022

40TH ANNIVERSARY



INTRODUCTION



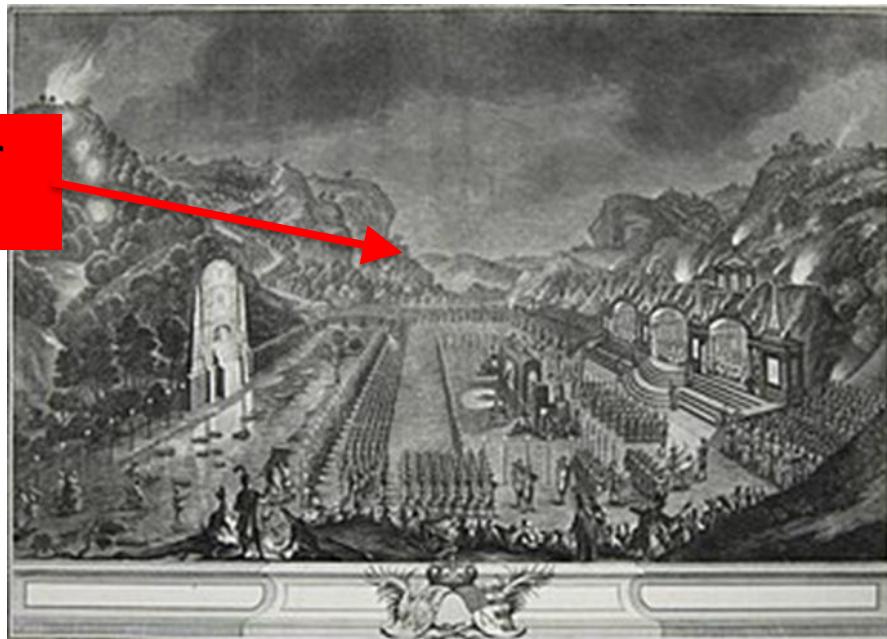
Felsenkeller
laboratory

PLAUENSCHER GRUND - AT THE BEGINNING OF THE 18TH CENTURY

Saturn feast at **1719** with parade of 1600 miners

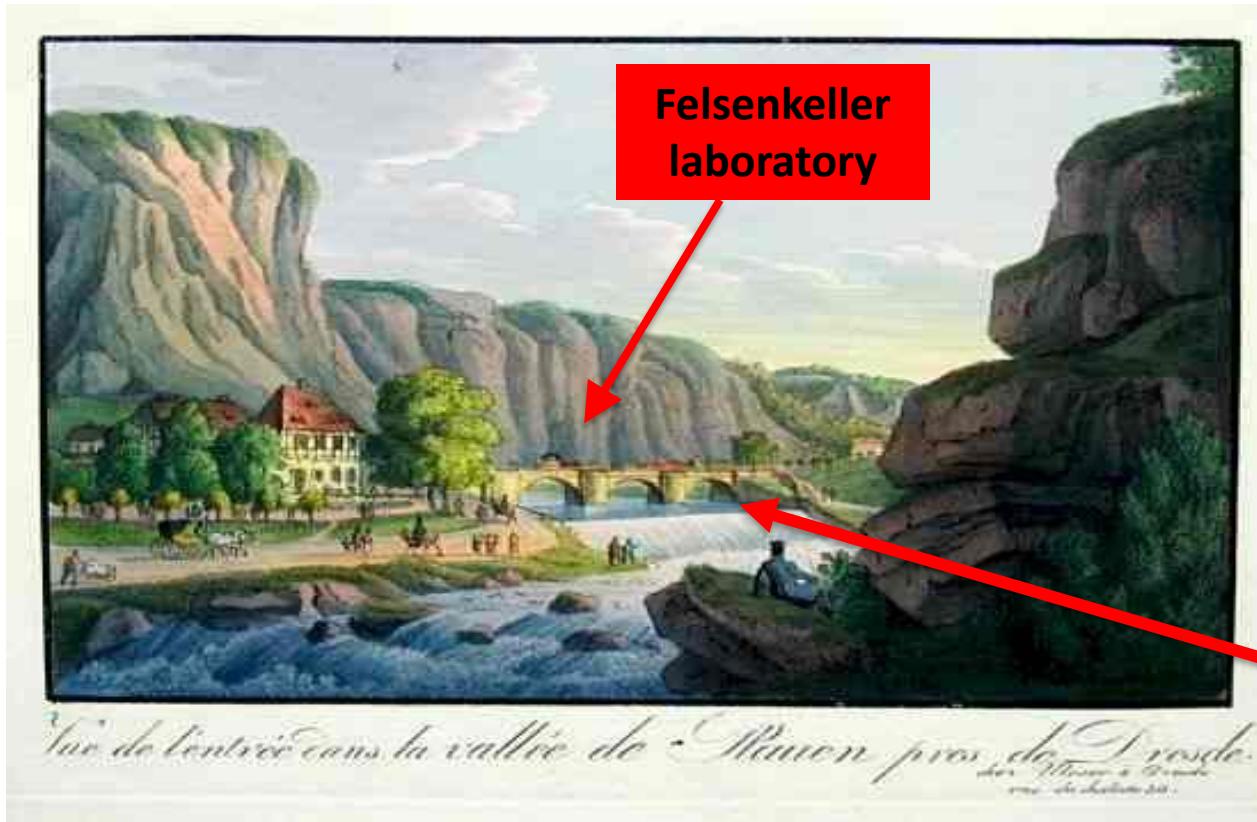
Part of the marriage ceremony between the daughter
Maria Josepha of the Austrian emperor and the crown
prince Friedrich August of Saxony

Felsenkeller
laboratory



PLAUENSCHER GRUND - AT THE BEGINNING OF THE 19TH CENTURY

Similar touristic attraction as Saxony Switzerland



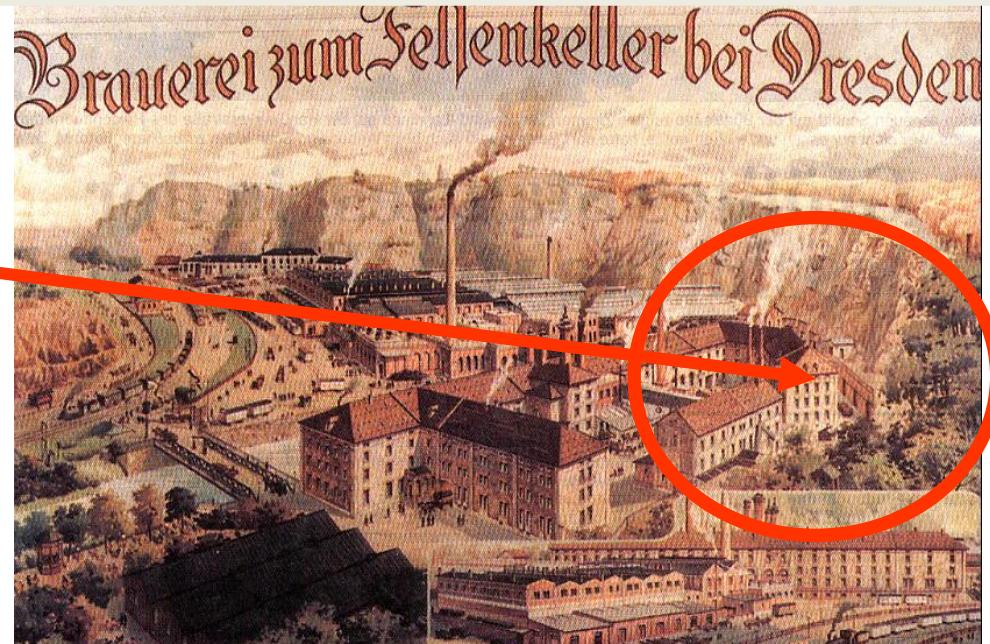
H. Kleist
W. Müller
H. C. Andersen
A. Zingg
A. Graff
C. D. Friedrich
L. Richter

PLAUENSCHER GRUND - RAPID INDUSTRIAL EXPANSION IN THE 19TH CENTURY

1855: construction of the Albert railway (Dresden - Tharandt)

1857/1858: construction of the Felsenkeller brewery

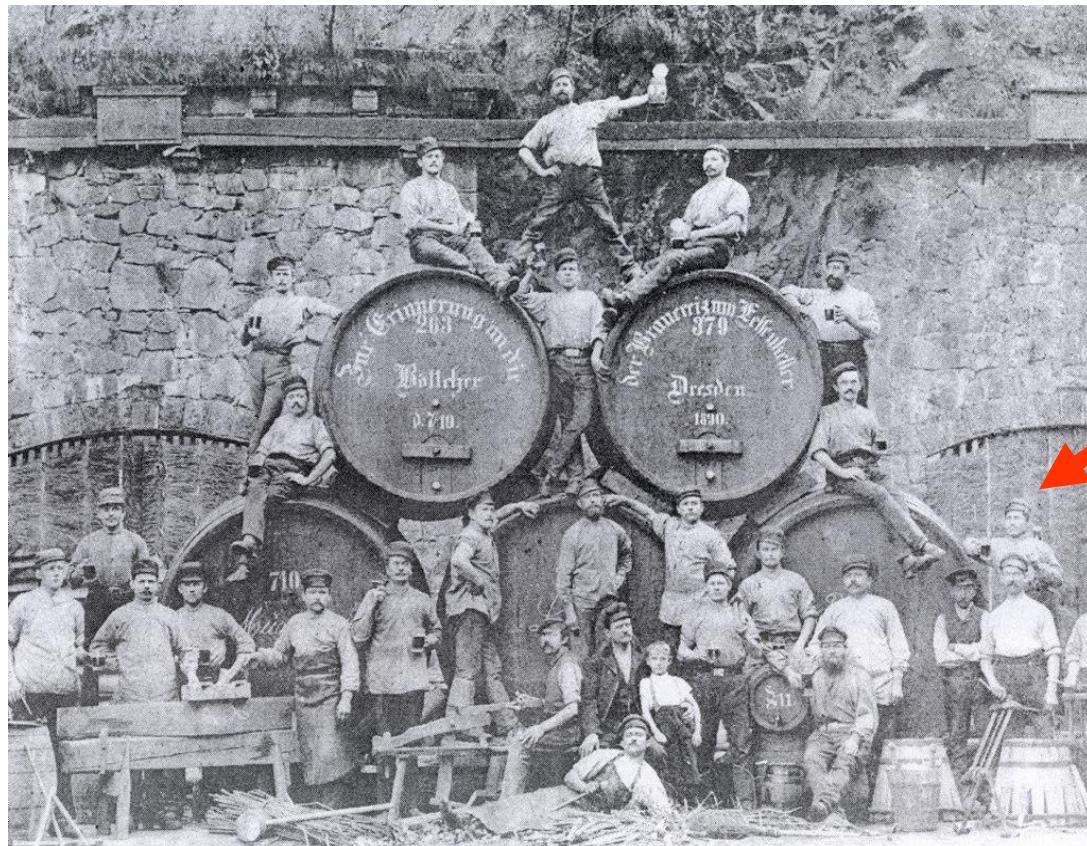
Felsenkeller
laboratory



1862/1863: galleries

1900: one of the 3 largest breweries in Germany

PLAUENSCHER GRUND - RAPID INDUSTRIAL EXPANSION IN THE 19TH CENTURY



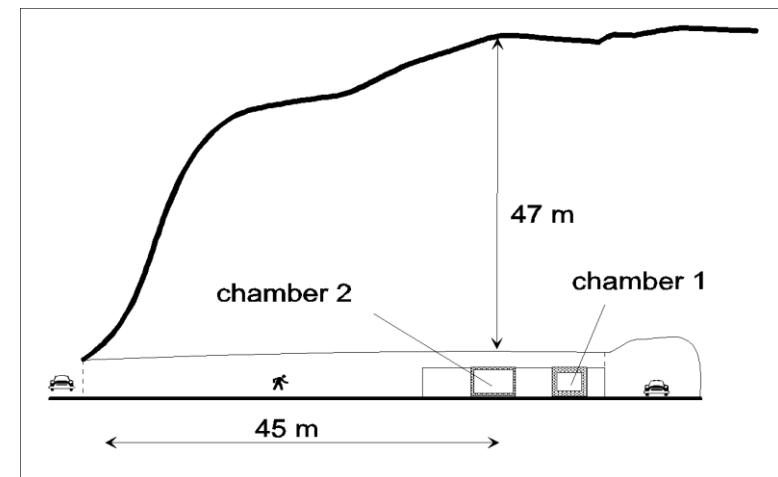
Felsenkeller
laboratory

1890: Ice storage within the galleries

UNDERGROUND LABORATORY FELSENKELLER – CONSTRUCTION OF SHIELDING CHAMBER 1

1978: first measurements with NaI-detectors

1982: construction of the shielding chamber 1,
GeLi γ -detector (75 cm^3)



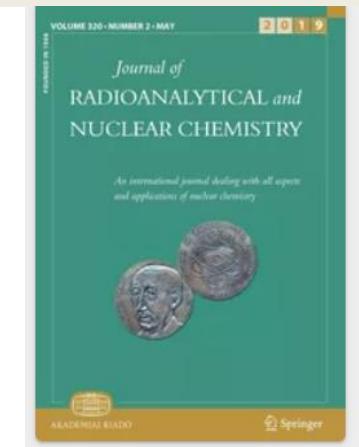
UNDERGROUND LABORATORY FELSENKELLER – NAA, BETA-GAMMA-KOINZIDENZ

**Determination of trace elements in semiconductor Si by
Neutron activation analysis (after radiochemical
separation)**

**Background reduction:
going underground
beta-gamma-coincidences**

Niese, S., & Helbig, W. (1986). Detection limits in activation analysis using Ge (Li)-detectors installed in an underground laboratory. *Journal of radioanalytical and nuclear chemistry*, 100(1), 155-163.

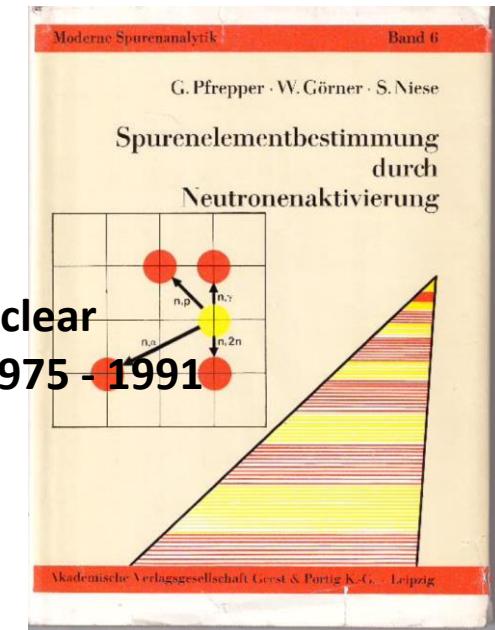
Niese, S., Helbig, W. & Kleeberg, H. Multi-sample beta-gamma coincidence spectrometry in an underground laboratory. *Journal of Radioanalytical and Nuclear Chemistry, Articles* 129, 387–391 (1989). <https://doi.org/10.1007/BF02039836>



UNDERGROUND LABORATORY FELSENKELLER – PROF. SIEGFRIED NIESE (1932 – 2021)



- ✓ Initiator of the underground laboratory Felsenkeller
- ✓ International Conferences on Nuclear Analytical Chemistry, Dresden, 1975 - 1991
- ✓ Idea provider
- ✓ Paternal authority



We owe it all to him.

UNDERGROUND LABORATORY FELSENKELLER – EARLY BIRD IN THE UNDERGROUND COMMUNITY

2002 - IAEA-MEL, Monaco (35 m w.e.)

1999 - PTB, Braunschweig (1200 m w.e.)

1994 - IRMM, Mol (500 m w.e.)

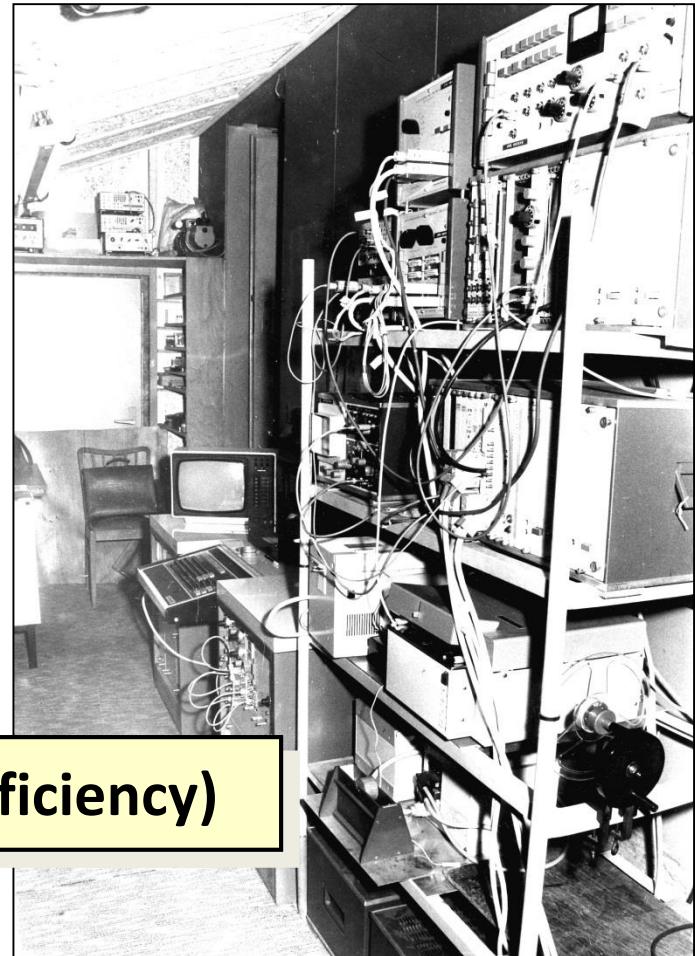
1989 - LNGS, GranSasso (3800 m w.e.)

1983 – LSCE, Modane (4800 m w.e.)

1982 – Felsenkeller, Dresden (110 m w.e.)

1970... – MontBlanc gallery, cellar university of Bern, Heidelberg

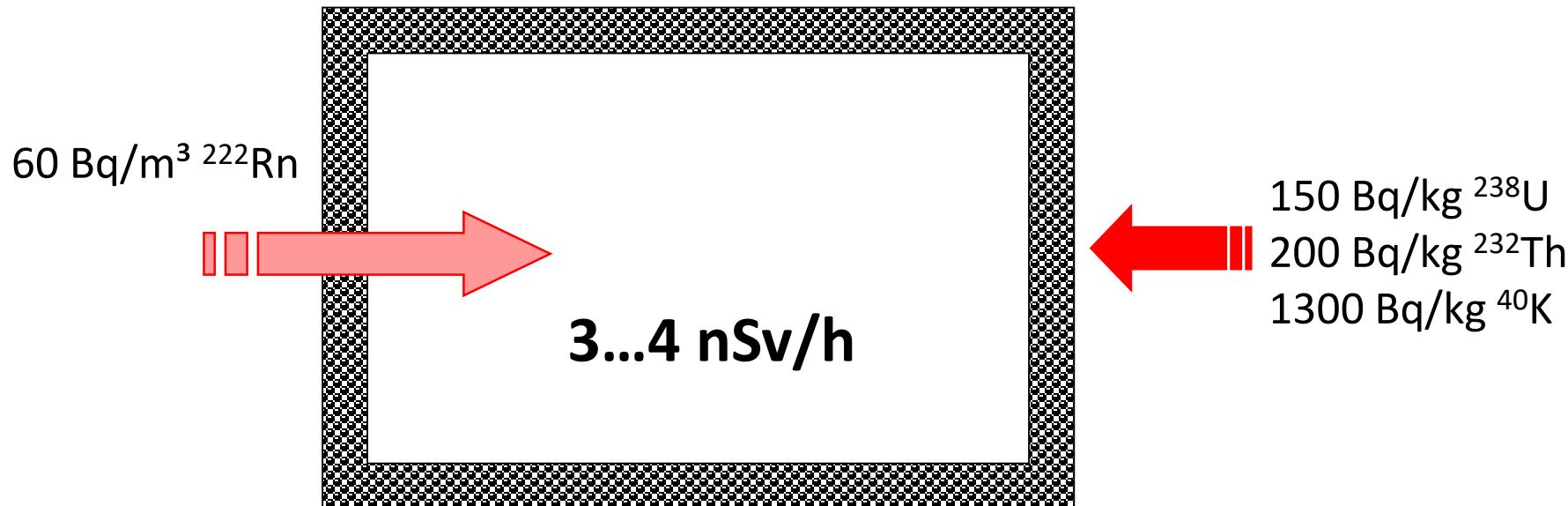
UNDERGROUND LABORATORY FELSENKELLER – γ -RAY SPECTROMETRY AT THE BEGINNING OF THE 90TIES



1991: first HPGe γ -detector (20% rel. efficiency)

UNDERGROUND LABORATORY FELSENKELLER – CONSTRUCTION OF THE SHIELDING CHAMBER 2 IN 1995

1992: shielding chamber 2



214 g/cm², 160 t steel and Pb
(3 * 6 * 2) m³

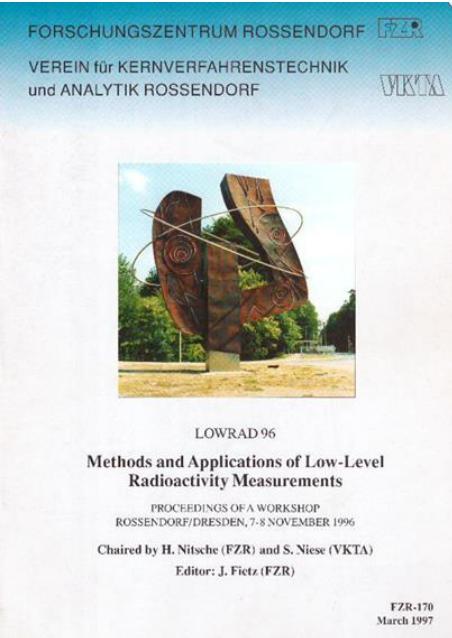
UNDERGROUND LABORATORY FELSENKELLER – CONSTRUCTION OF THE SHIELDING CHAMBER 2



UNDERGROUND LABORATORY FELSENKELLER – HIGHLIGHTS FROM THE 1990TIES

1996: International Workshop

Methods and Applications of Low-level Radioactivity Measurements



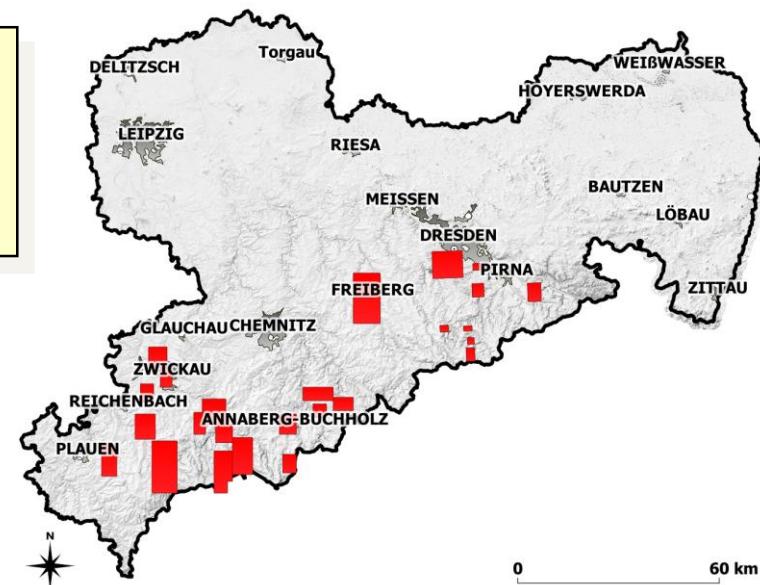
1996: Determination of ${}^3\text{H}$ after electrolytical enrichment

1997: Installation of a whole body counter

1999: extension of the underground buildings

UNDERGROUND LABORATORY FELSENKELLER – HIGHLIGHTS FROM THE 1990TIES

- ✓ database of environmental contaminations from former uranium mining activities (1945 – 1989)



- ✓ analyses for the remediation of the former uranium mining area in Königstein near Dresden



UNDERGROUND LABORATORY FELSENKELLER – HIGHLIGHTS FROM THE 2000TIES

2000: first CELLAR meeting



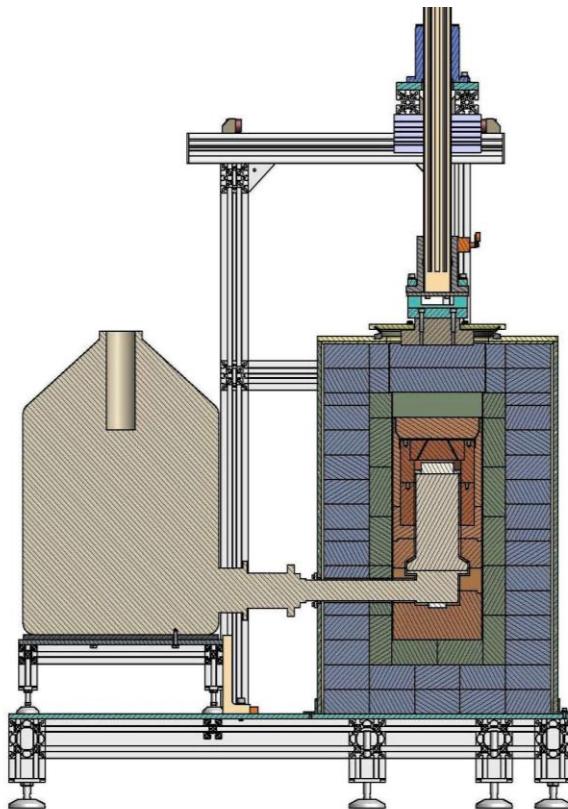
UNDERGROUND LABORATORY FELSENKELLER – HIGHLIGHTS FROM THE 2000TIES

2002: flood of the Weisseritz river



UNDERGROUND LABORATORY FELSENKELLER – HIGHLIGHTS FROM THE 2000TIES

2007: installation of the ULB-system (92% rel. efficiency)



✓ Radiopurity of 17 detector materials tested

✓ 200 d measurement time within the CELLAR collaboration

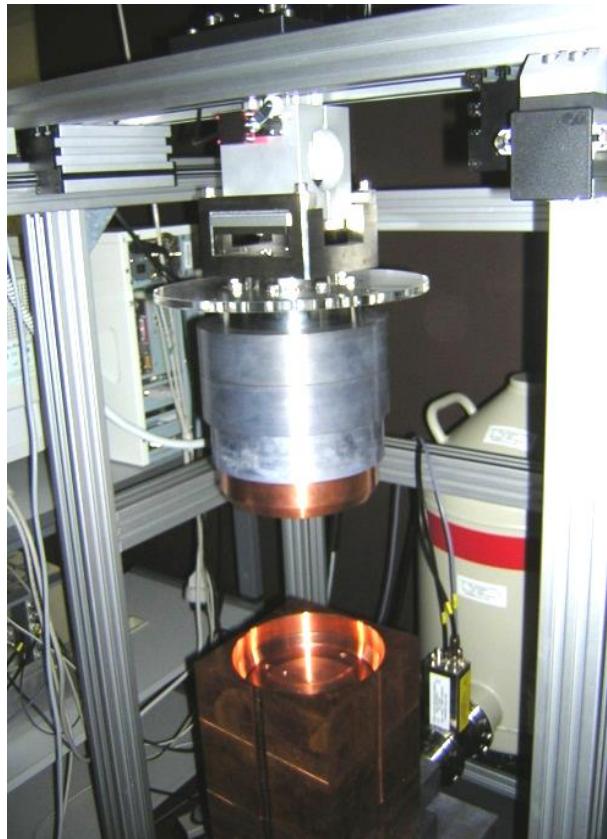


✓ substitution of brass by old steel
✓ additional lead within the detector

✓ 5 cm Cu, 10 + 5 cm Pb

UNDERGROUND LABORATORY FELSENKELLER – HIGHLIGHTS FROM THE 2000TIES

2007: installation of the ULB-system (92% rel. efficiency)



- ✓ integral background countrate $0,034 \text{ s}^{-1} \text{ kg}^{-1}$
- ✓ factor 3 better as older Felsenkeller detectors
- ✓ factor 4 better as above ground systems with veto detector
- ✓ factor 100 worse as deep underground systems

UNDERGROUND LABORATORY FELSENKELLER – HIGHLIGHTS FROM THE 2000TIES

2007: installation of the ULB-system (92% rel. efficiency)



Contents lists available at [ScienceDirect](#)

Applied Radiation and Isotopes

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



A new low-level γ -ray spectrometry system for environmental radioactivity
at the underground laboratory *Felsenkeller*

M. Köhler^{a,*}, D. Degering^a, M. Laubenstein^b, P. Quirin^c, M.-O. Lampert^c, M. Hult^d, D. Arnold^e,
S. Neumaier^e, J.-L. Reyss^f

✓ ICRM LLRMT Braunschweig

✓ Most cited paper from Felsenkeller: **60 citations**

UNDERGROUND LABORATORY FELSENKELLER – HIGHLIGHTS FROM THE 2000TIES

2010: 10th CELLAR-Meeting



**Fire in the conference hotel
Evacuation of the participants
in the night**

2012: transfer of PTB-detector from UDO/ASSE



UNDERGROUND LABORATORY FELSENKELLER – TODAY

Environmental radioactivity

- **Geothermal energy**

(^{226}Ra , ^{228}Ra , ^{224}Ra ... in geothermal fluids, ^{226}Ra , ^{228}Ra , ^{228}Th in scales)

- Luminescence dating

- ^3H

Consumer protection

- ^{226}Ra and ^{228}Ra in **tap and bottled water** (see D. Degering)

- Radionuclides in medical ceramics

- **Remediation of contaminated sites** (uranium mining, NORM)

Rare decay processes

- **Meteorites** (see D. Degering)

- Double beta decay (see K. Zuber)

Decommissioning of nuclear installations

- Clearance, nuclide vectors

UNDERGROUND LABORATORY FELSENKELLER – TODAY

equipment

- Present situation see D. Degering

staff

- ≈ 2 employees

sales & samples

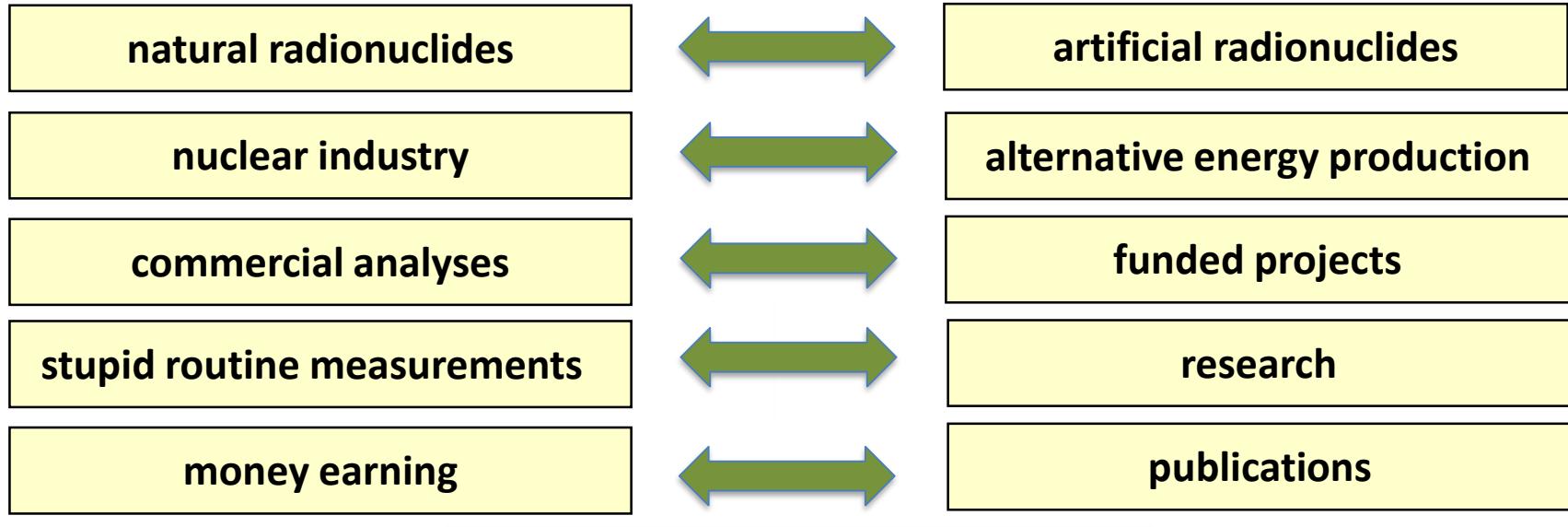
- 250.000 € / a (commercial & projects)
- 2000 samples / a

science

- 50 publications, 1000 citations
- 50 reviews

CONCLUSIONS

diversification



- ✓ easy adaption to changing requirements of the market
- ✓ independent from decisions in science policy