



The future demand for geological reference materials

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International Association of Geoanalysts
<http://geoanalyst.org>

IAG certification program since 2003

Certification according to ISO/REMCO guides

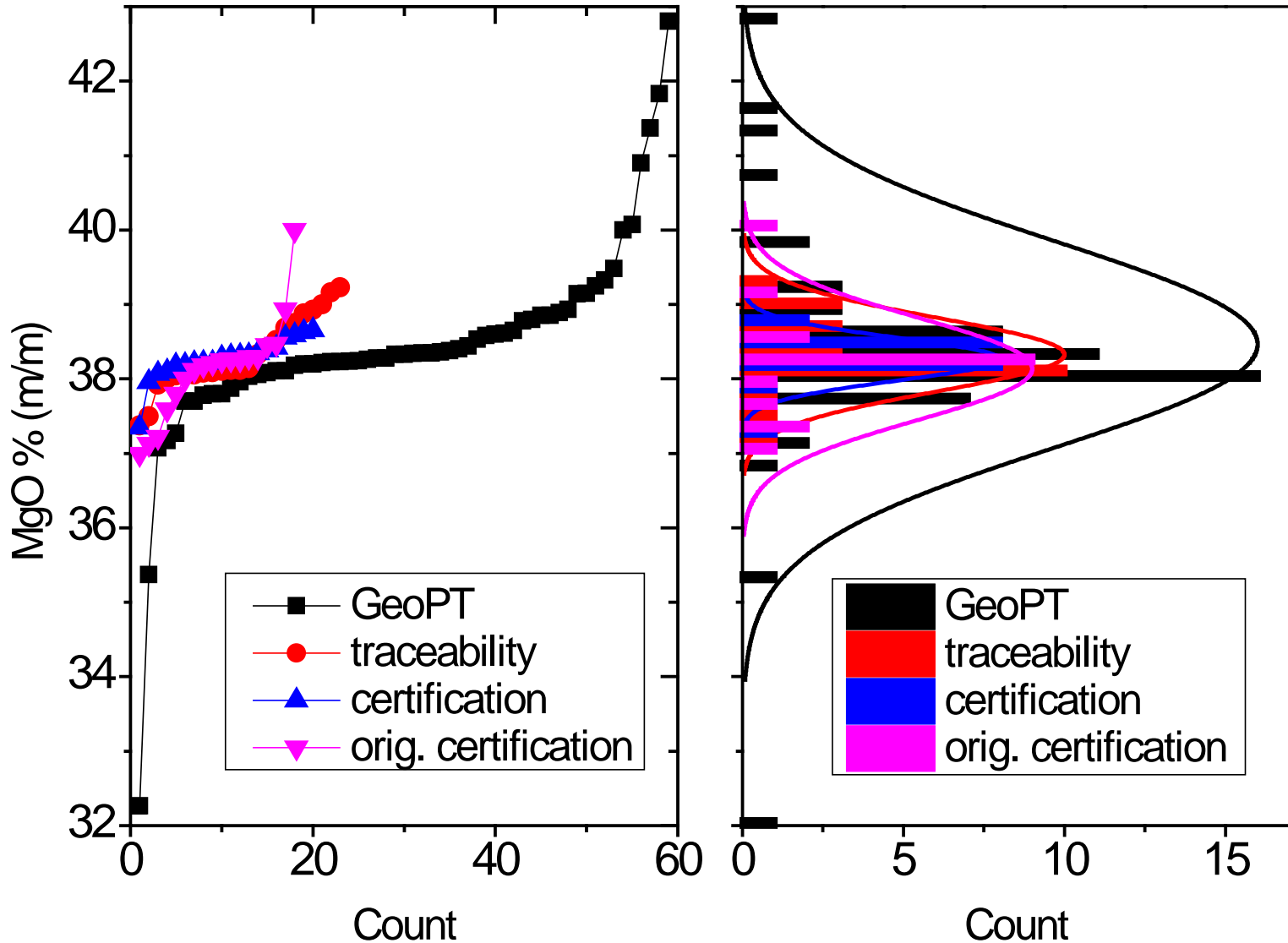
IAG

- Officially founded 1997
- Proficiency test program GeoPT with silicate materials since 1996 (28 round sofar)
- G-Probe PT with microanalytical materials

IAG

- Certification program since 2003
 - So far 5 certified RM with silicate matrix
- Collaborative certification through labs that qualified through *GeoPT*

MgO in GAS

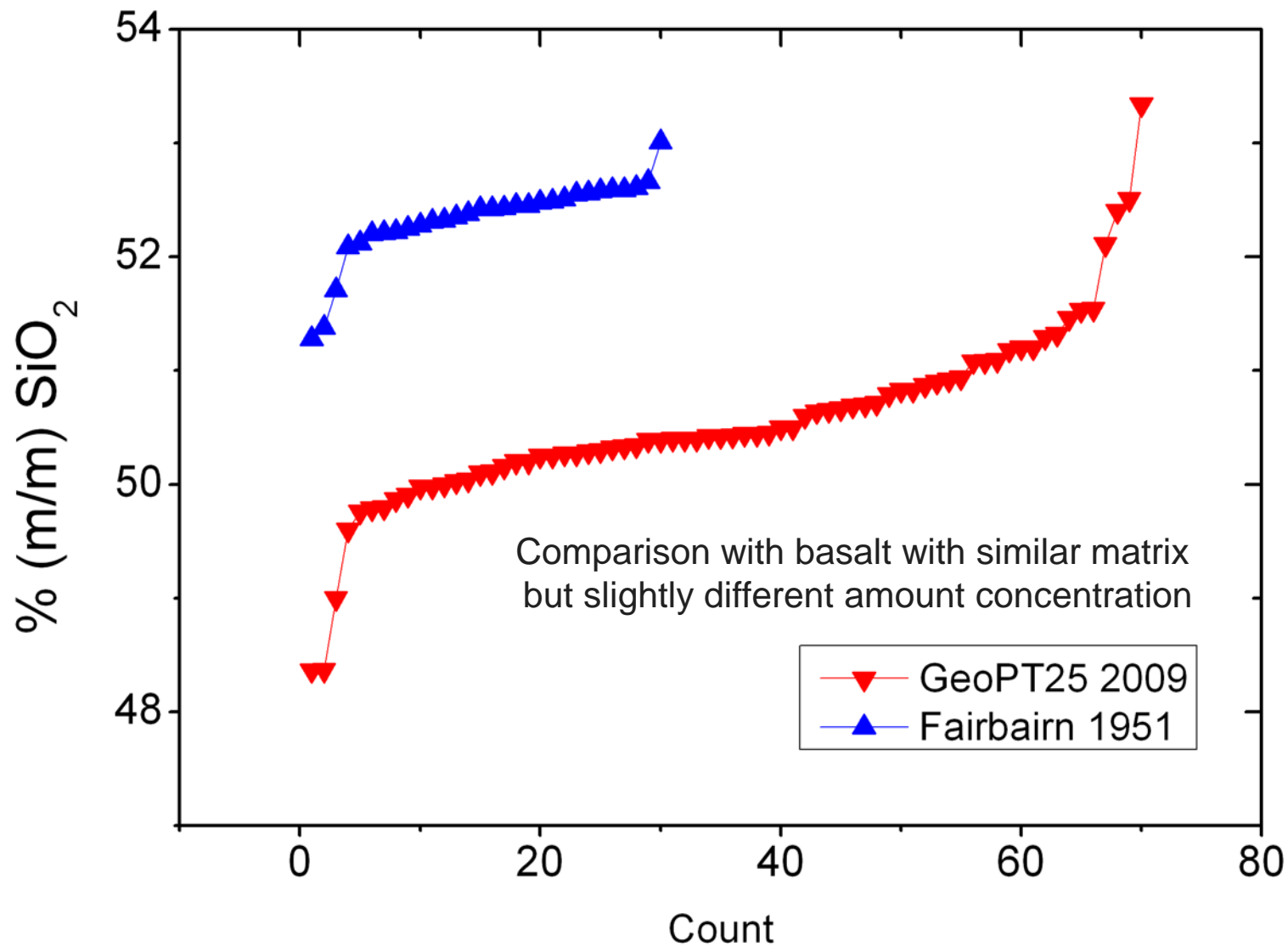


Going back in time

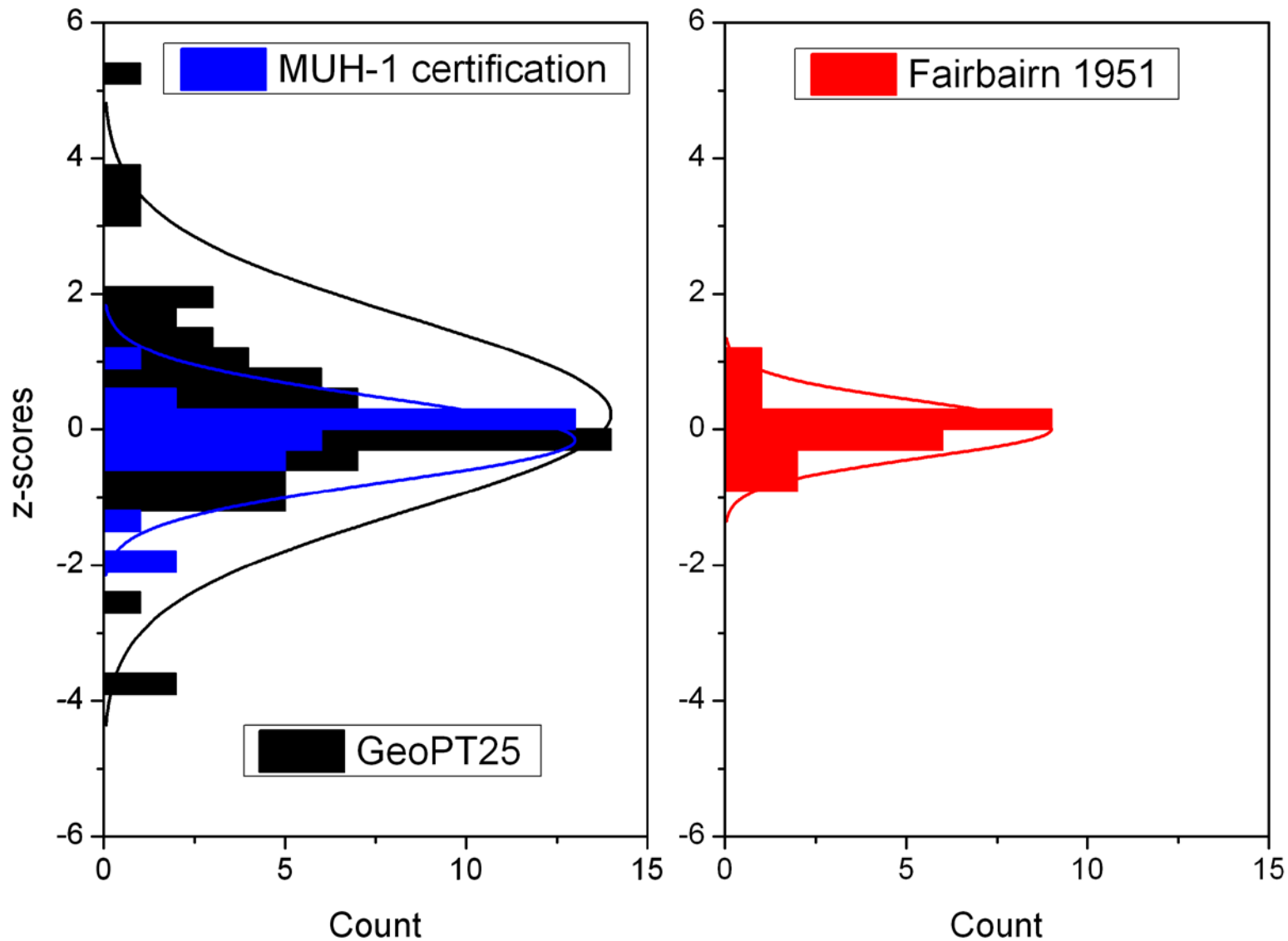
- First interlaboratory comparison in 1951 (Fairbairn et al.)
- G-1 (granite) and W-1 (basalt) first internationally used geological RM
- Prepared for matrix matched calibration purposes of dc arc spectrometry
- Ca. 40 kg bottled (ca. 500 units) each

G-1 and W-1

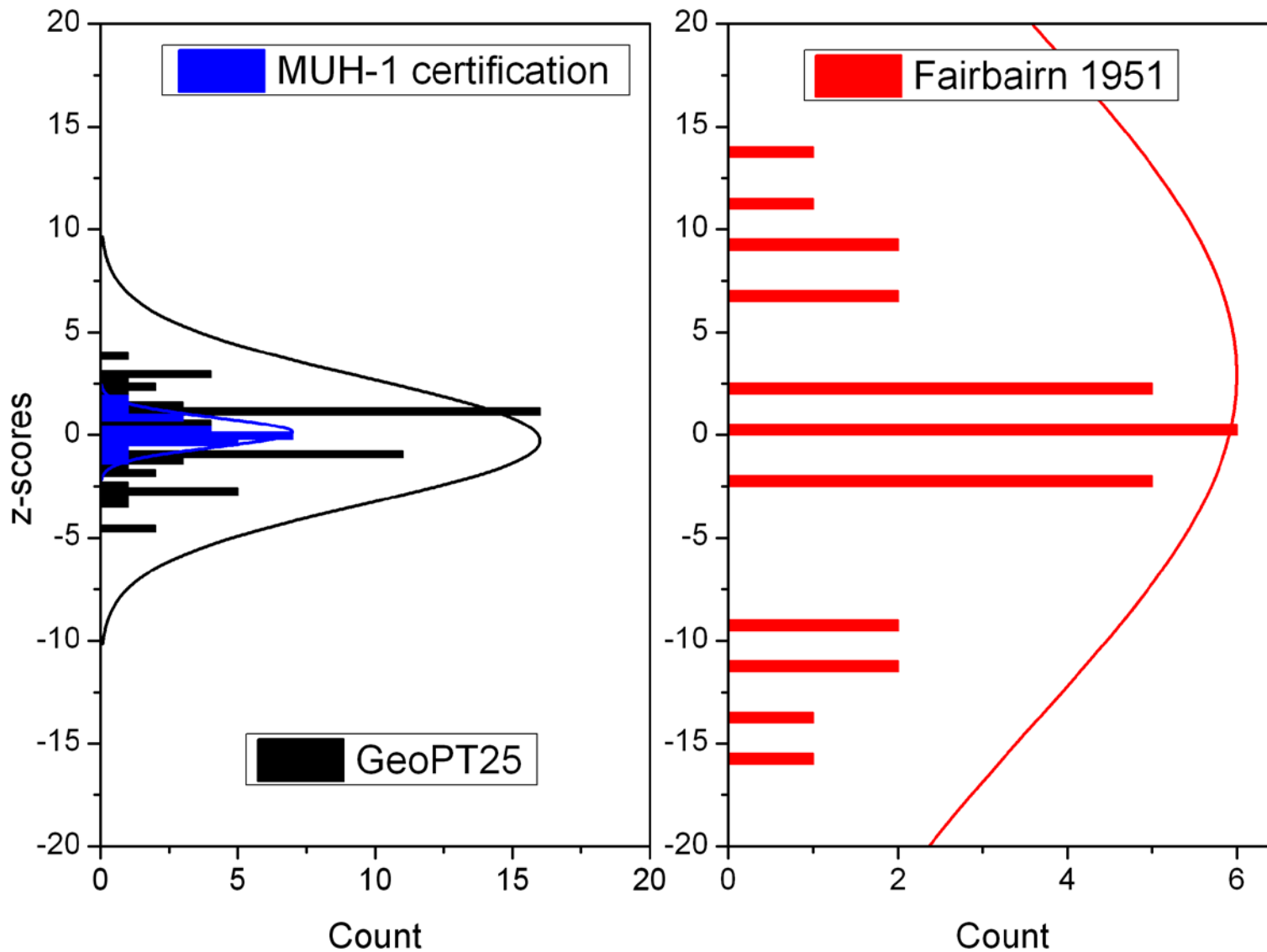
- 30 expert laboratories (Univ., Industry, Government labs)
- Classical methods applied
 - Gravimetry
 - Titrimetry
- No RM existed at that time for method validation purposes!



SiO₂ concentration ca. 50 %(m/m)

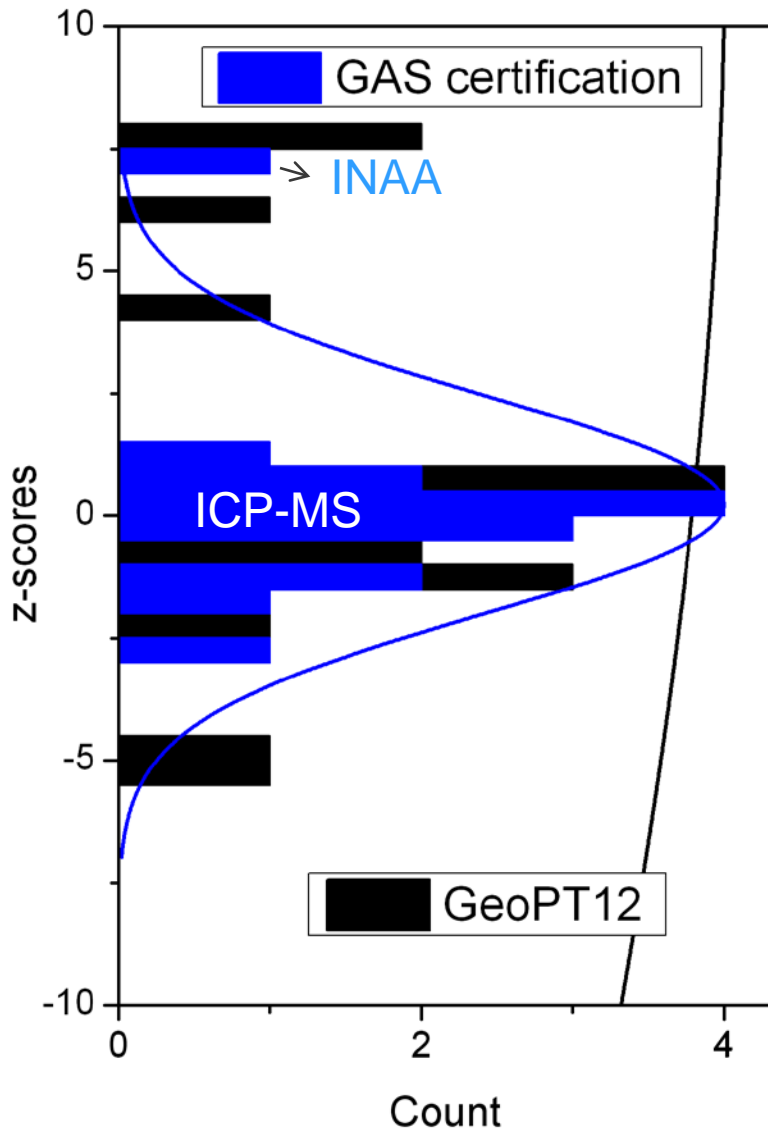


MnO concentration 0.1 %(m/m)



1951-2010

- Sub $\mu\text{g/g}$ range accessible and validated
- Sub ng/g level accessible with ICP-MS
- Rare earth elements (lanthanoids) now routine



Eu concentration
0.01 $\mu\text{g/g}$

1951-2010

- More than 1000 geological RM produced (USGS, JGS, China...)
 - Many different matrices
 - Soils
 - Sediments
 - Magmatic and volcanic rocks
 - Minerals
 - glasses

91500 zircon

BCR-1

NIST SRM 987

KL2-G

JR-1

H	GeoReM																He
Li	Be											B	C	N	O	F	Ne
Na	Mg											Al	Si	P	S	Cl	Ar
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe
Cs	Ba	La	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn
Fr	Ra	Ac															
		Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu		
		Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr		



MAX-PLANCK-GESELLSCHAFT

GeoReM contains about 2,150 reference materials, almost 22,000 analyses from almost 4,400 papers, and preferred analytical values (State: 04/01/2010).

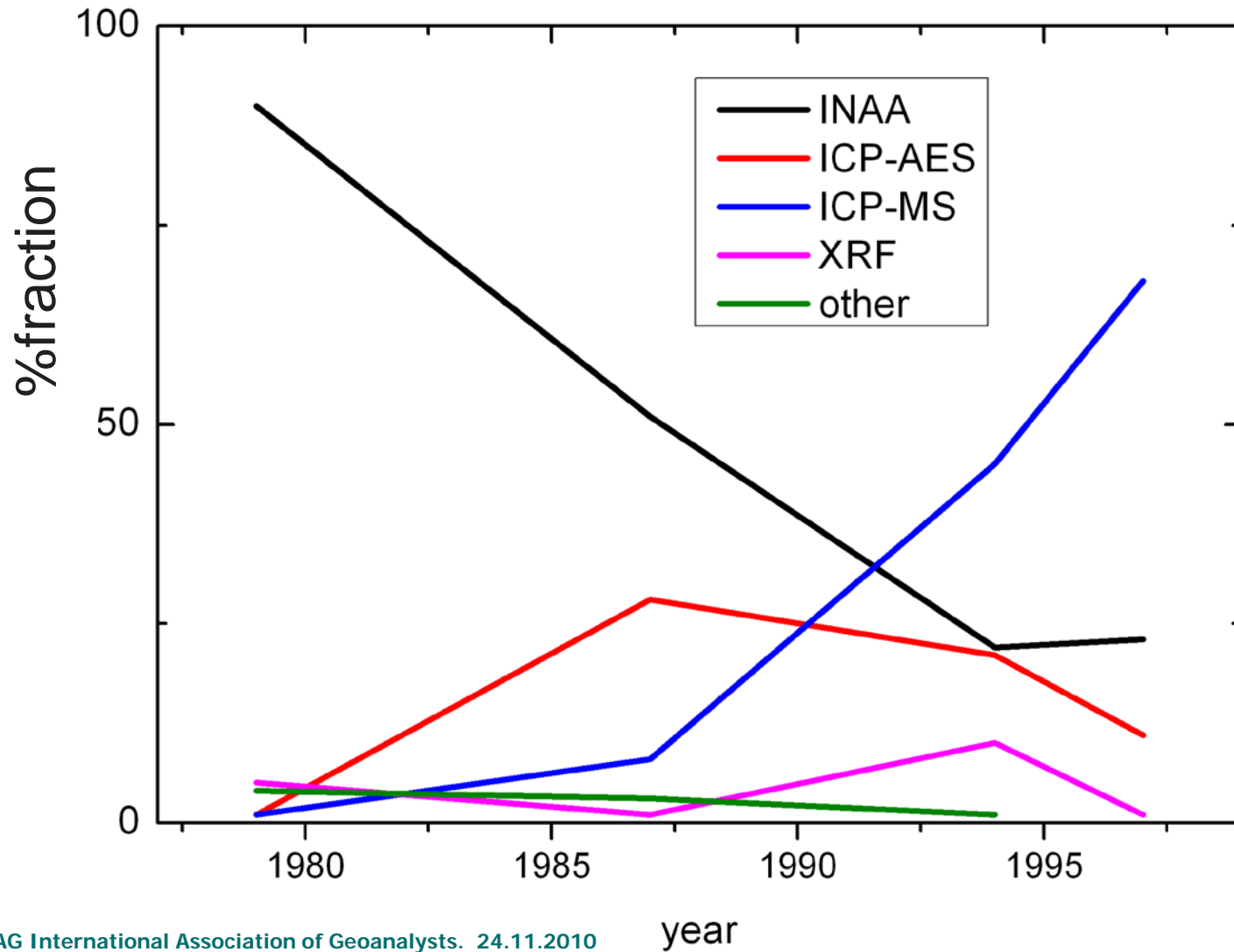
<http://georem.mpch-mainz.gwdg.de/>

1951-2010

- More than 1000 geological RM produced (USGS, JGS, China...)
 - Many different matrices
- Very few certified according to modern metrological approaches (e.g. by IAG)
- Classical methods almost gone
- NAA fading out
- XRF and ICP-MS dominating

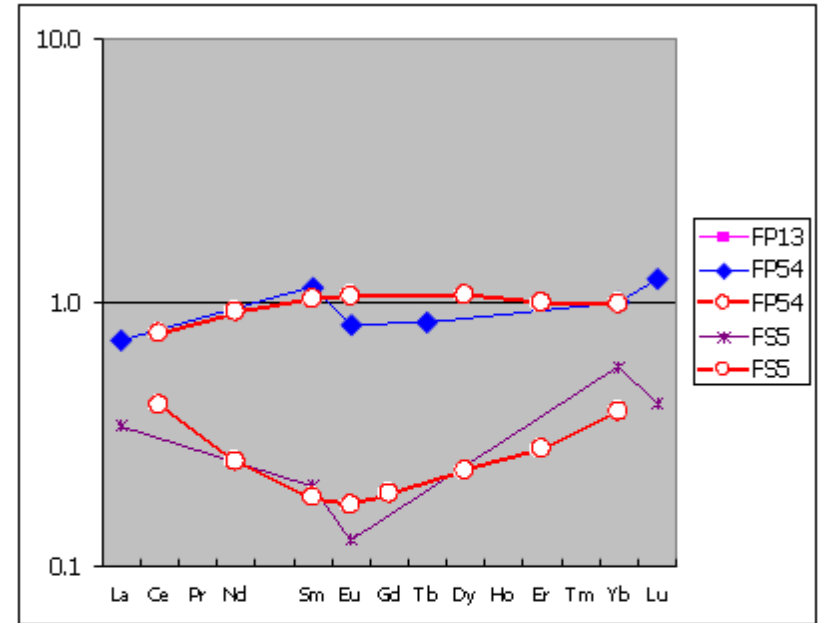
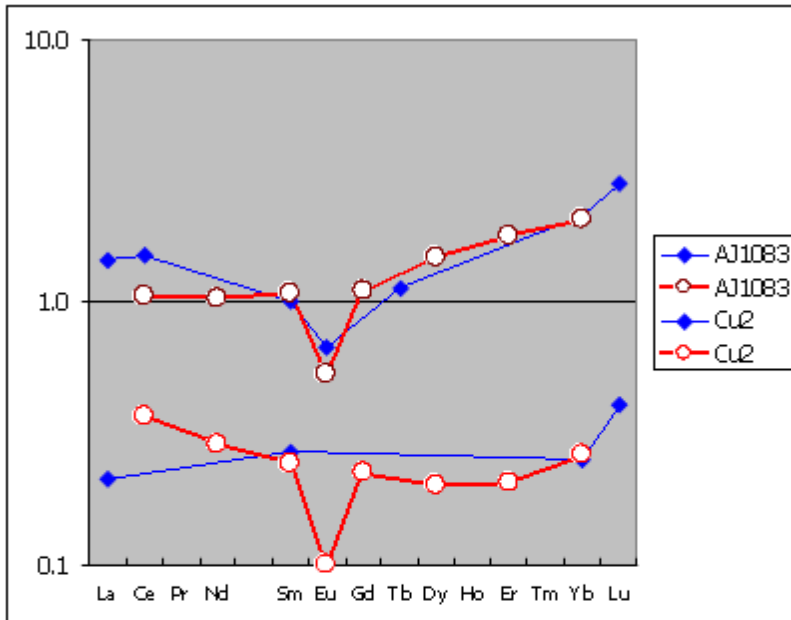
1951-2010

methods used for Eu and Hf



INAA vs. ID-TIMS

Chondrite normalised values



Biino and Meisel 1993
Meisel et al. 1996

Cannot rely only on ICP-MS
Independent method are needed for certifications

New challenges

- Bi, Tl, Sb, Te, Se
- PGE (Rh, Pd, Ru, Os, Ir and Pt) as well as Re



New challenges

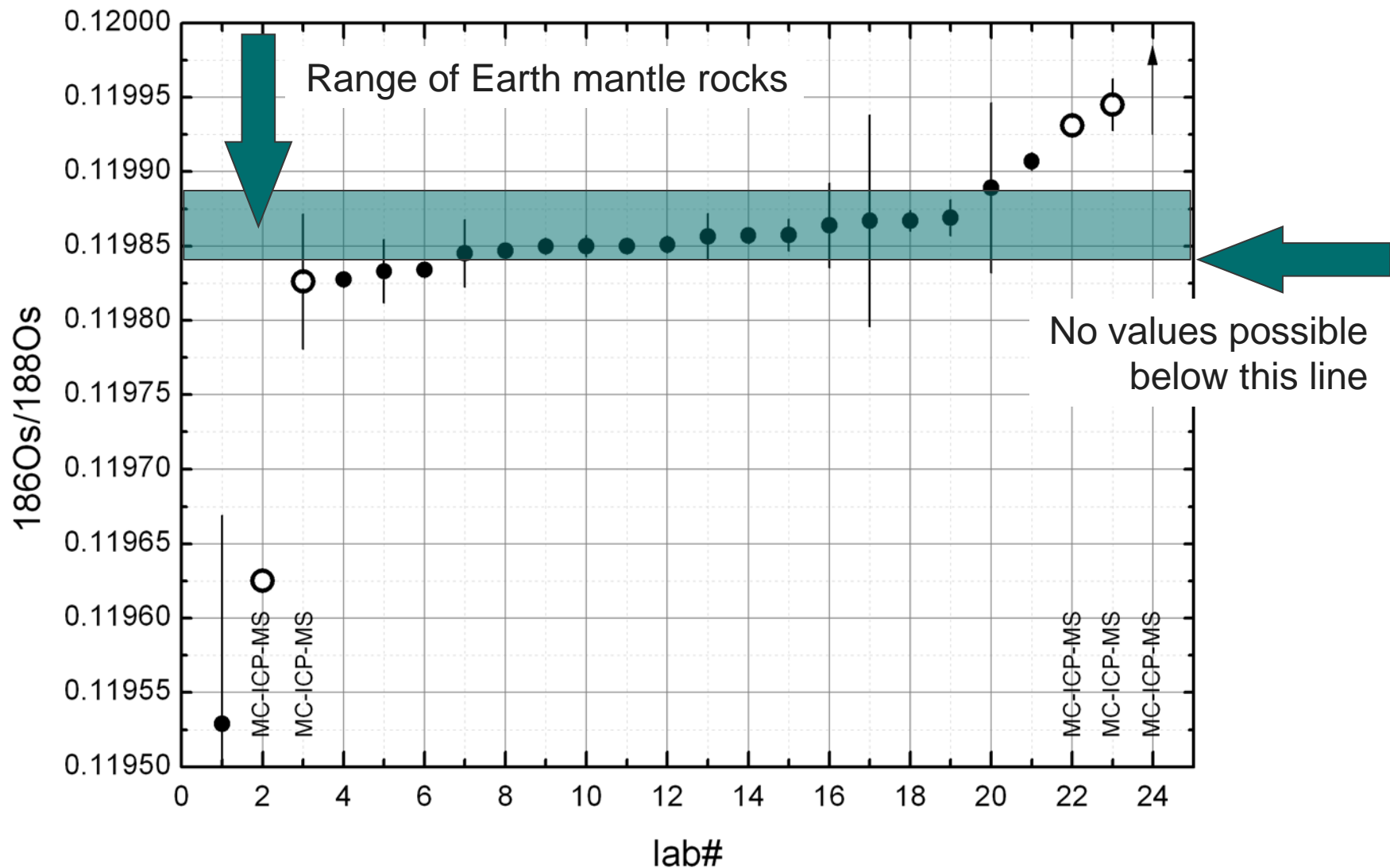
- Bi, Tl, Sb, Te, Se
- PGE (Rh, Pd, Ru, Os, Ir and Pt) as well as Re
 - Concentrations in lower ng/g and pg/g range are still challenging
 - low concentrations
 - homogeneity/sampling issues
 - incomplete digestion

2010- New challenges

- Fewer labs using “primary” methods available
- TIMS
 - used with non certified RM solutions
 - No common matrix matched RM
- MC-ICP-MS new fields in geochemistry explored
 - “non traditional stable isotopes”
 - Establishing “delta zero” materials

Interlaboratory comparison LOsST

● 186Os/188Os



Further challenges

- Production of matrix matched RM for
 - isotope amount ratio measurements
 - Microanalytical techniques
 - SIMS, EMPA, μ -beam XRF
 - LA-ICP-MS for in-situ analysis
 - also for isotope amount ratios
 - age determinations etc.

2010-2020

- IAG in collaboration with other international organisations (e.g. USGS, IRMM?) trying to fill in the gap

