European Commission

REIMEP-22: Interlaboratory Comparison on U Age Dating

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REIMEP-22 in details

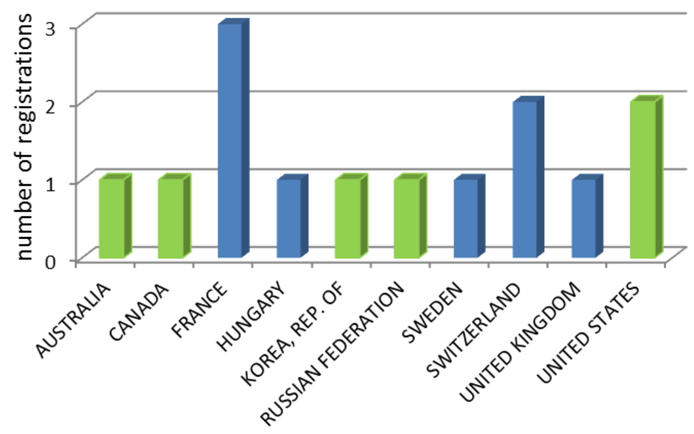
Prior to the release of a novel uranium Reference Material (IRMM-1000) to be certified for the production date, the EC-JRC-IRMM launched in compliance with ISO 17043 a new Inter-laboratory Comparison REIMEP-22 (Regular European Inter-laboratory Measurement Evaluation Programme) on "U Age Dating - Determination of the production date of a uranium certified test sample" based on this material. (*see presentation IAEA CN-218/29 on IRMM-1000*)

Participants in REIMEP-22 were asked to take part in two comparisons either on a 20 mg and/or 50 mg uranium certified test sample with an undisclosed value for the production date depending whether they applied a mass spectrometric or a radiometric technique.

Based on the use of the natural radioactive decay and disequilibrium of radionuclides from the U-series in the sample, they were asked to measure, using their routine laboratory procedures, the $^{230}Th/^{234}U$ (compulsory) and $^{231}Pa/^{235}U$ (optional) amount or activity ratios in a 20 mg or 50 mg uranium certified test sample respectively and report its production date.

Registrations and Participants

REIMEP-22 particularly targeted laboratories and institutes from the Nuclear Forensics International Technical Working Group (ITWG) but also other laboratories in the field of nuclear science or geochemistry worldwide.



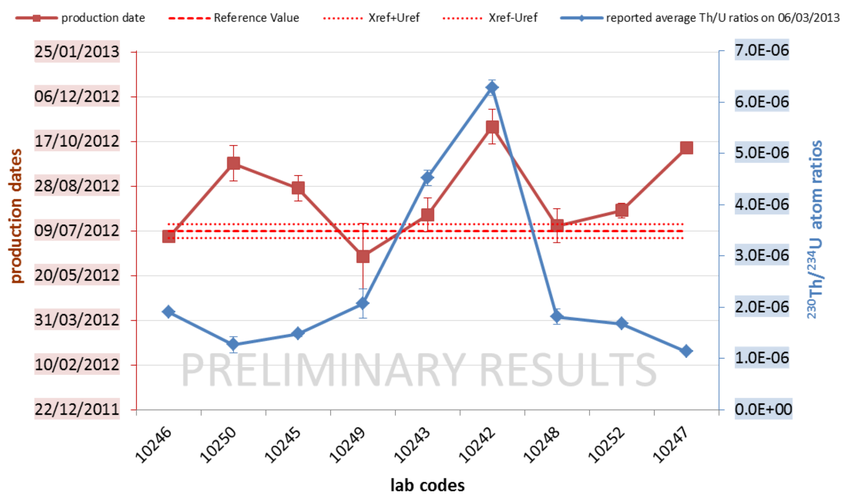
In total, 14 laboratories registered for REIMEP-22 with 2 laboratories participating in the two comparisons (20 mg and 50 mg uranium certified test samples)

Finally, 9 laboratories reported results for the 20 mg uranium sample (using spectrometric methods and reporting amount ratios) and 4 laboratories for the 50 mg uranium sample (using radiometric methods and reporting activity ratios).

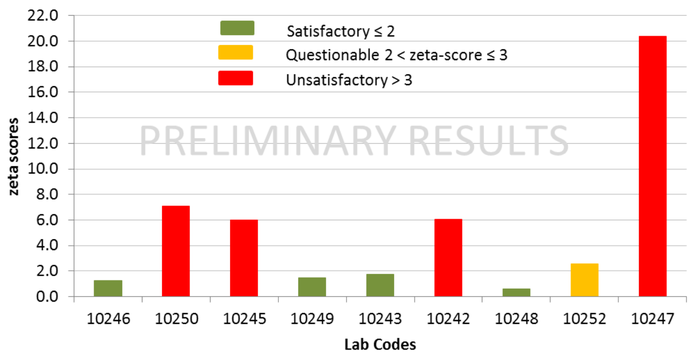
Reporting results – $^{230}Th/^{234}U$

- Report the amount/activity ratios in 3 replicates as measured on the 6th March 2013.
- Report the average value of the replicates for the 6th March 2013 as well.
- Using the average ratio, calculate the age of the material and report the production date as dd/mm/yyyy and the uncertainty in days (with coverage factor k= 1 or 2).

Comparison on 20 mg REIMEP-22 sample



20mg REIMEP-22 zeta scores

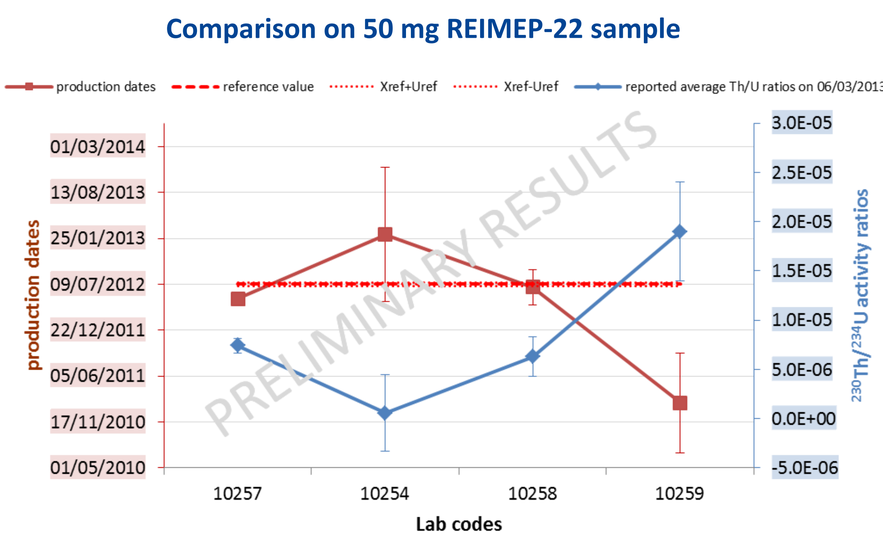


$$\text{zeta} - \text{score} = \left| \frac{X_{ref} - X_{lab}}{\sqrt{(U_{ref}/k)^2 + (U_{lab}/k)^2}} \right|$$

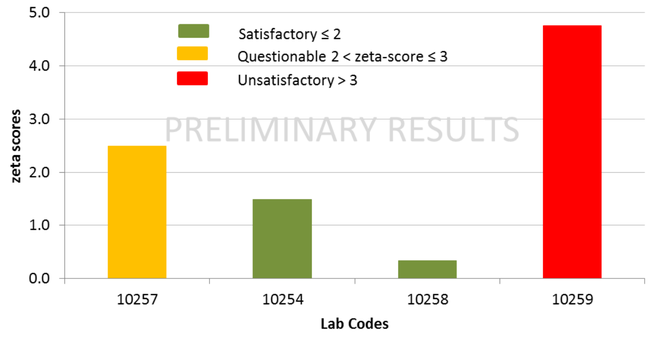
X_{ref} reference value (date) and U_{ref}
X_{lab} reported production date and U_{lab}

- *Four labs reported production dates that agree well with the reference value, so separation of the ^{230}Th from the ^{234}U in the certified test sample was successful.*
- *The other labs either underestimated the uncertainties on the production date or found "younger" ages (perhaps due to an incomplete recovery of the thorium in the certified test sample using their analytical method).*
- *For two labs, reported ratios do not match with the reported production dates, either ratios were not reported for the reference date and/or these labs had problems in calculating the production dates from the average ratio.*

Comparison on 50 mg REIMEP-22 sample

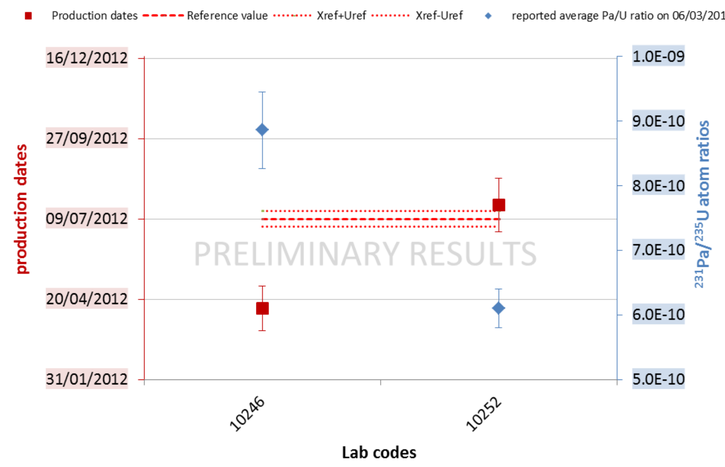


50mg REIMEP-22 zeta scores



- *Good agreement between reported activity ratios and the production dates.*
- *2 labs reported production dates that agree well with the reference value.*

Reporting results - $^{231}Pa/^{235}U$



Even the Pa/U clock in the IRMM-1000 could be used to determine the production date, although IRMM-1000 will not be certified for this specific clock.

https://ec.europa.eu/jrc/en

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