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Preparation and Calibration of USGS54, USGS55, and USGS56 Wood Isotopic Reference Materials

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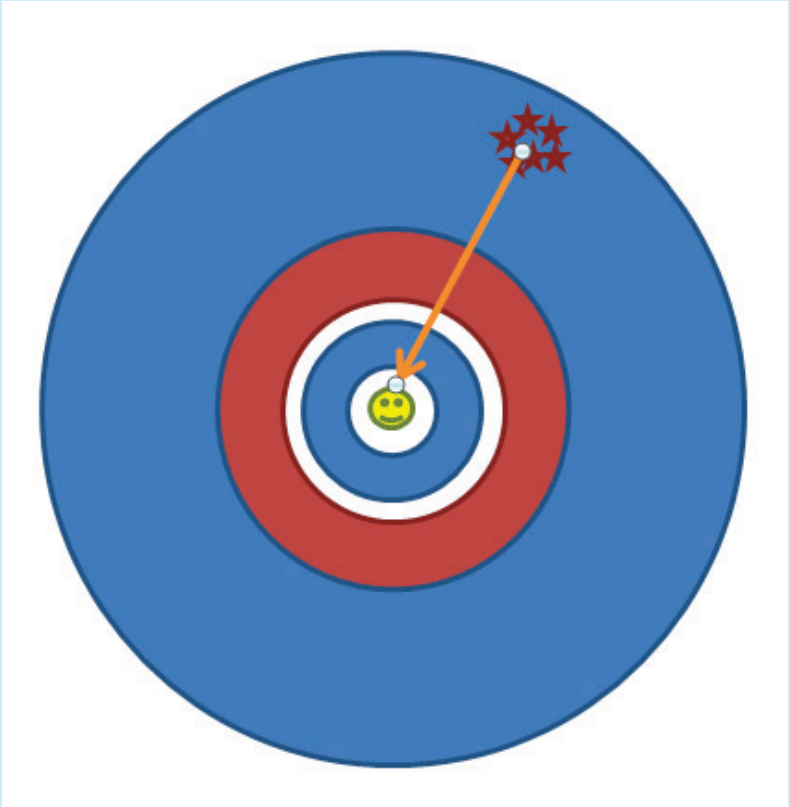
The goal of using isotopic reference materials

- Normalize measured isotope-delta values with high precision but low accuracy relative to “true” values
- Enable any isotope laboratory worldwide to measure the same sample and obtain the same isotope-delta value within analytical uncertainty
- Require 2-point normalization using two isotopic reference materials with contrasting isotopic compositions for accurate isotope-delta measurements



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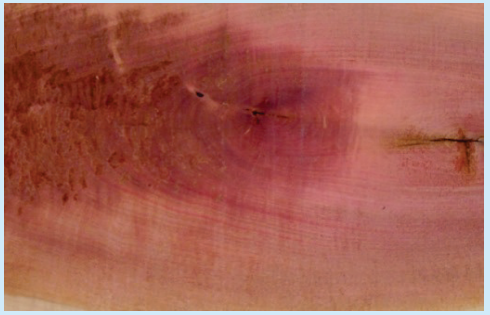
Challenges and Problems

- The development of suitable wood stable isotopic reference materials has not kept pace with the rapid development of continuous-flow stable isotope-ratio mass spectrometry coupled with on-line elemental analyzer (CFIRMS-EA) techniques
- Because no wood isotopic reference materials existed, USGS prepared and calibrated three wood materials

USGS54 (*Pinus contorta,* Canadian Lodgepole pine)

USGS55 (*Cordia dodecandra,* Mexican ziricote)



USGS56 (Berchemia zeyheri, South African red ivorywood)

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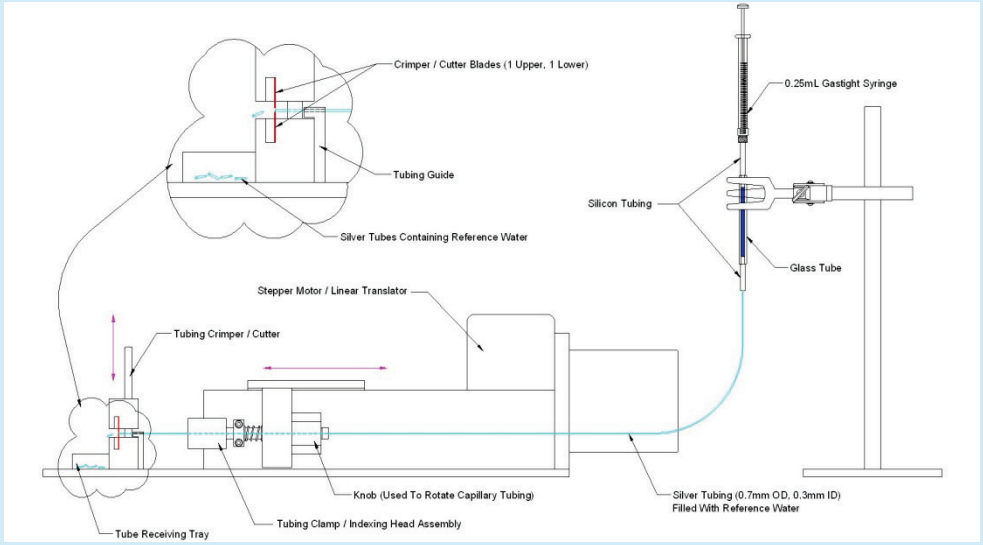
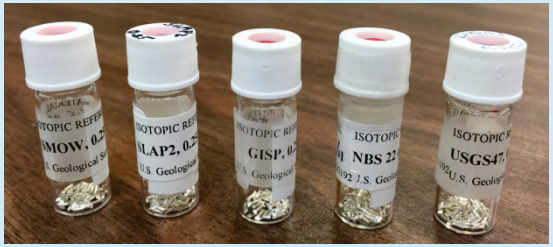
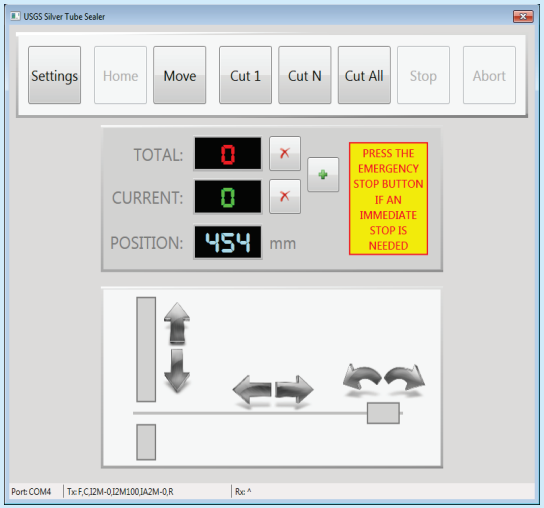
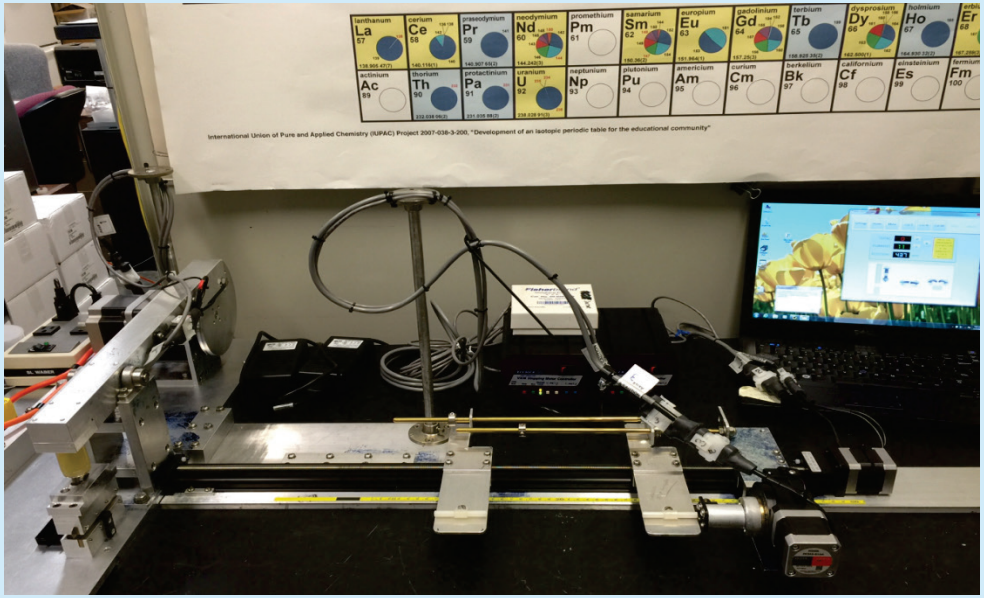
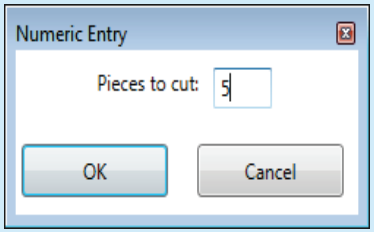
Silver tube method for $\delta^{2}H$ and $\delta^{18}O$ measurements





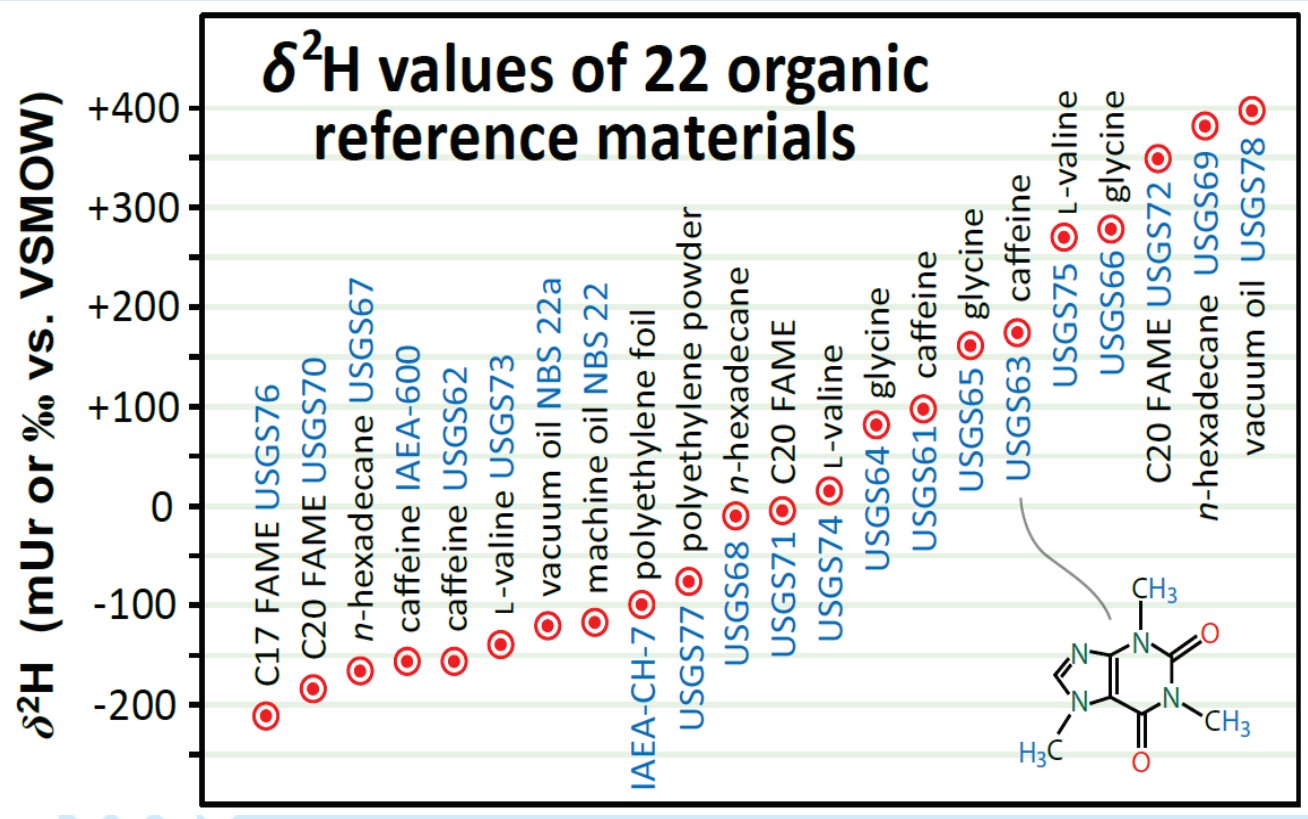






Silver tube method—how well does it work?

- **Very successfully—used in the calibration of at least 25 internationally distributed isotopic reference materials in over a dozen laboratories worldwide**



All δ^2H values obtained by on-line (TC/EA) method using reference water sealed in silver tubes from 7 laboratories agreed well with δ^2H values measured by an off-line method

Schimmelmann et al. 2016. *Anal. Chem.* 88, 4294-4302

Isotope-delta values of wood reference materials

Name	$\delta^{2}H$	$\delta^{18}O$	$\delta^{13}C$	$\delta^{15}N$
USGS54	–150.4 mUr	+17.79 mUr	–24.43 mUr	–2.42 mUr
USGS55	–28.2 mUr	+19.12 mUr	–27.13 mUr	–0.3 mUr
USGS56	–44.0 mUr	+27.23 mUr	–24.34 mUr	+1.8 mUr

Qi et al., *Chemical Geology* 442 (2016) 47–53.

mUr = 0.001 = 1 per mil, where urey (symbol Ur) is named after Harold C. Urey

- Relatively large range in $\delta^{2}H$ and $\delta^{18}O$ values among wood reference materials
- Relatively small range in $\delta^{13}C$ and $\delta^{15}N$ values among wood reference materials

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The Final Result

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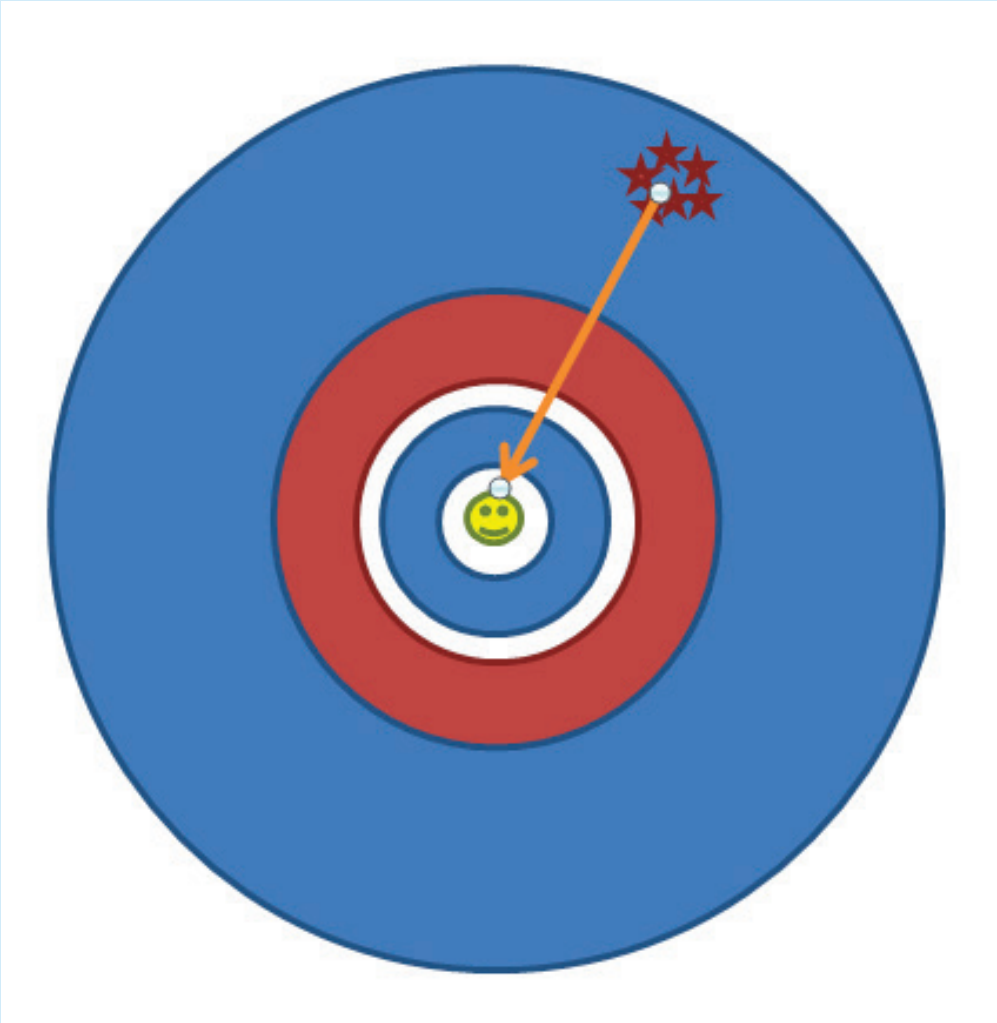
Target your target from high precision to high accuracy



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Thank you

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