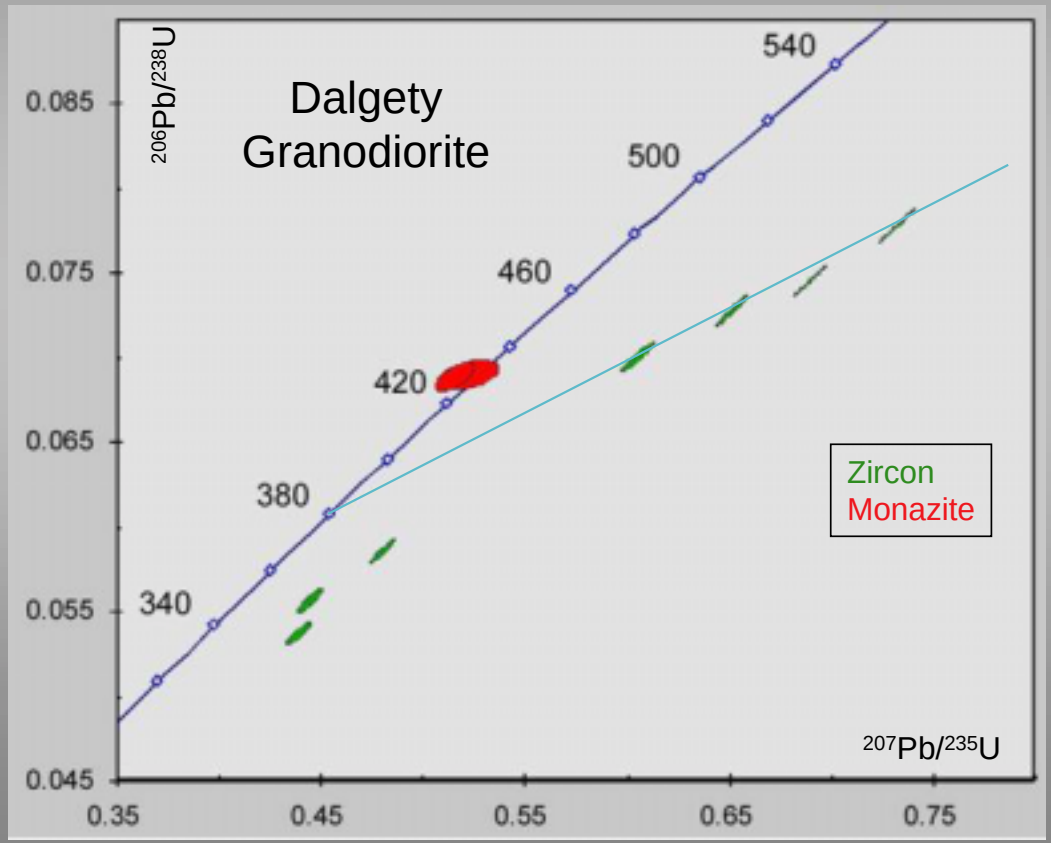
Microanalysis

Ion Microprobe

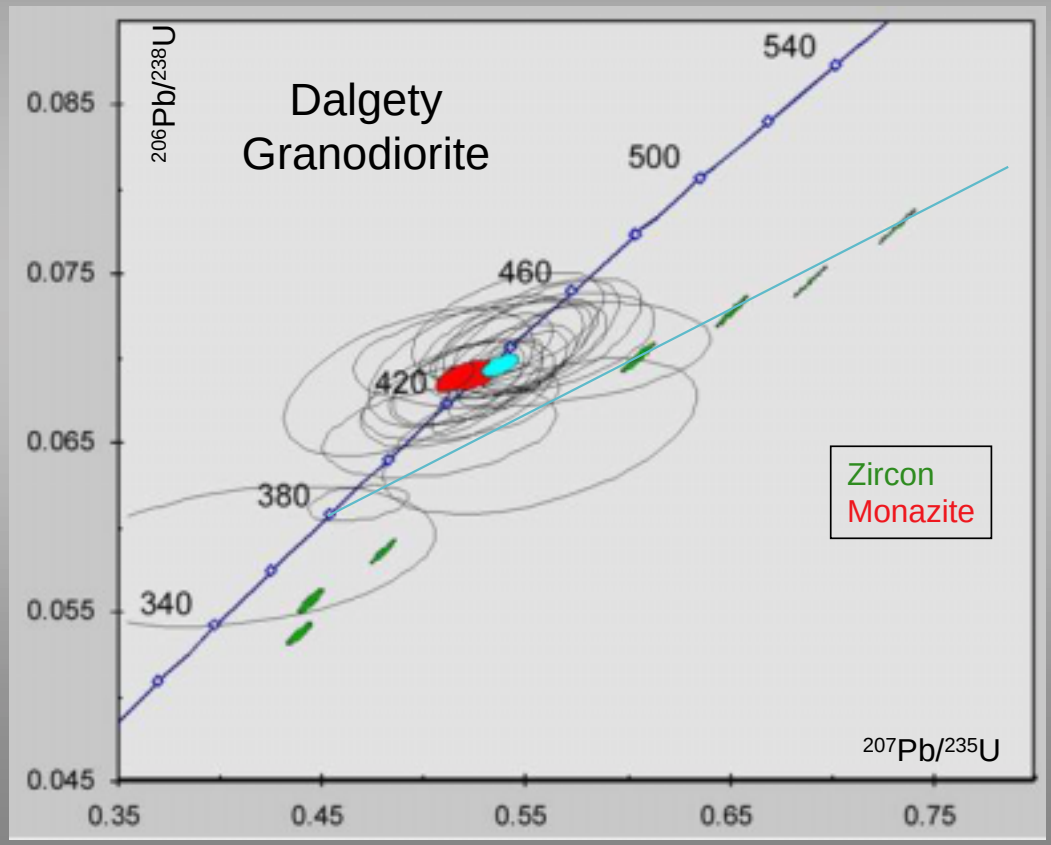
Old S-type
Isotope Dilution
Monazite older
than inferred
zircon age

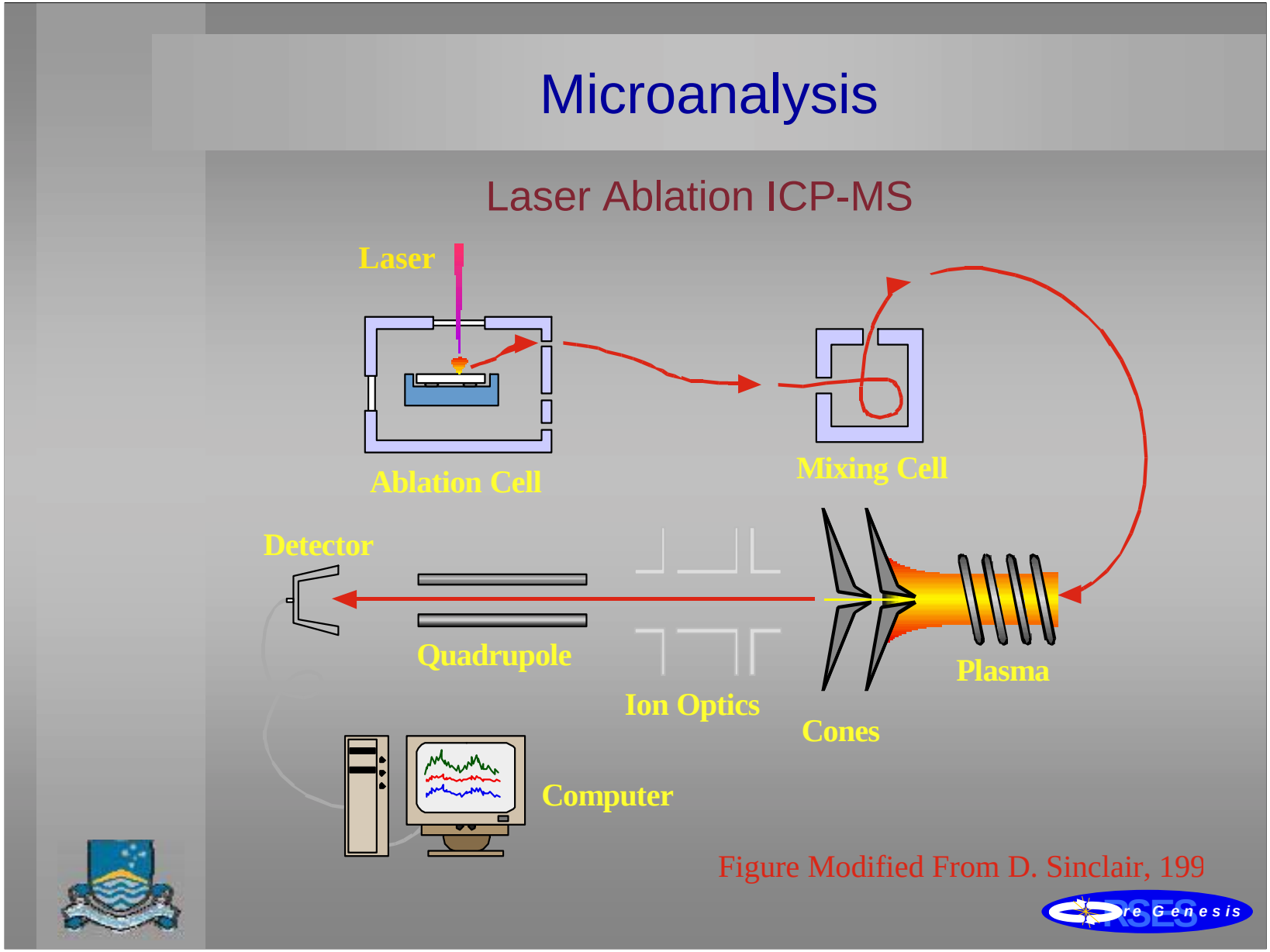


Microanalysis

Ion Microprobe

Old S-type
Ion Microprobe
Melt-precipitated zircon is the same age as the monazite

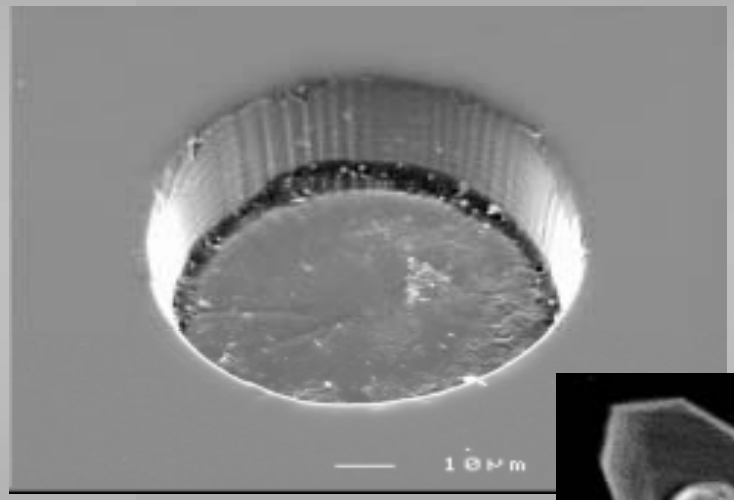


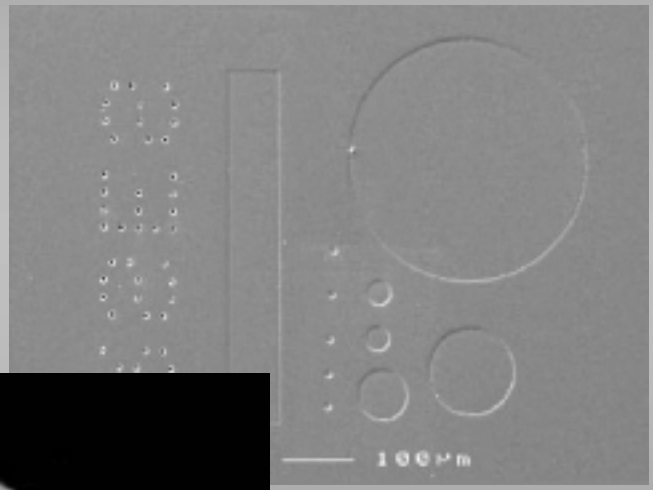


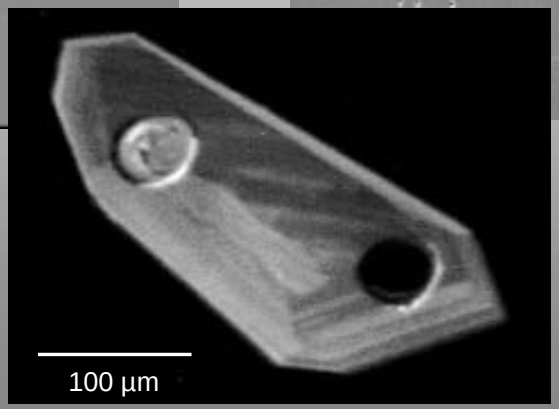
Microanalysis

Laser Ablation ICP-MS

ArF Excimer (193 nm) laser





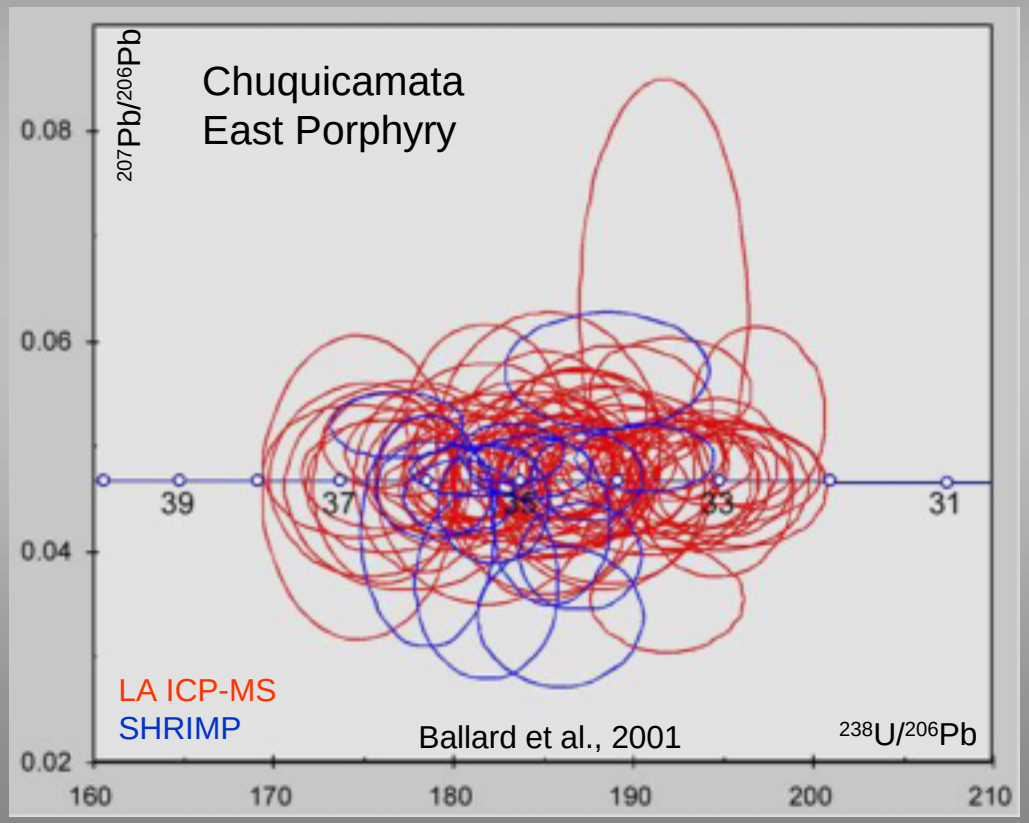


Precision micro-sampling

Microanalysis

Laser Ablation ICP-MS

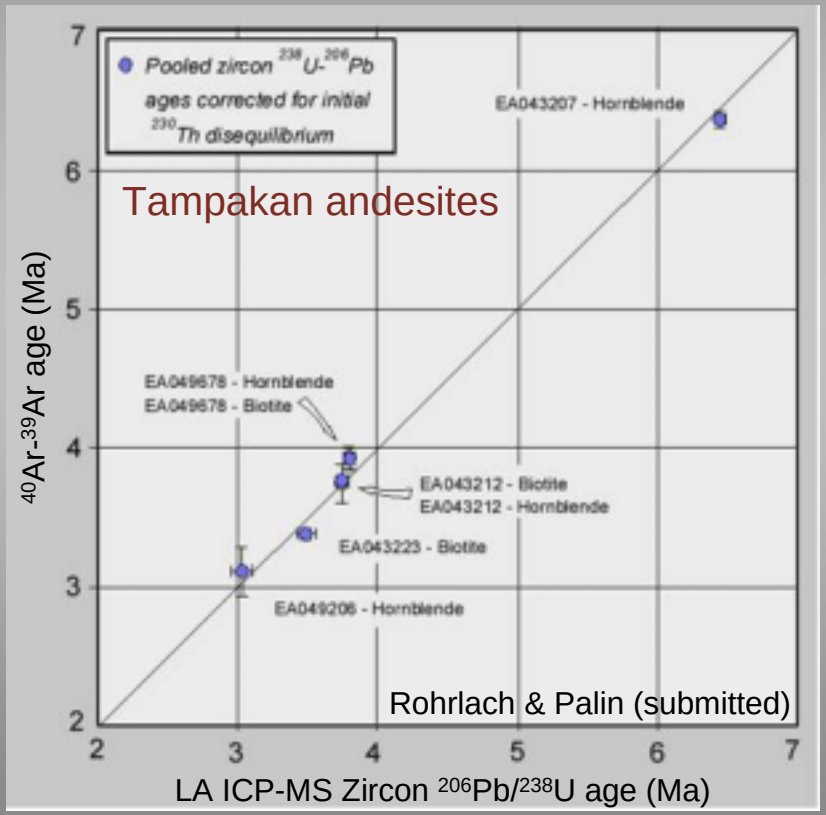
Analyses comparable precision to Ion Microprobe



Microanalysis

The question of accuracy

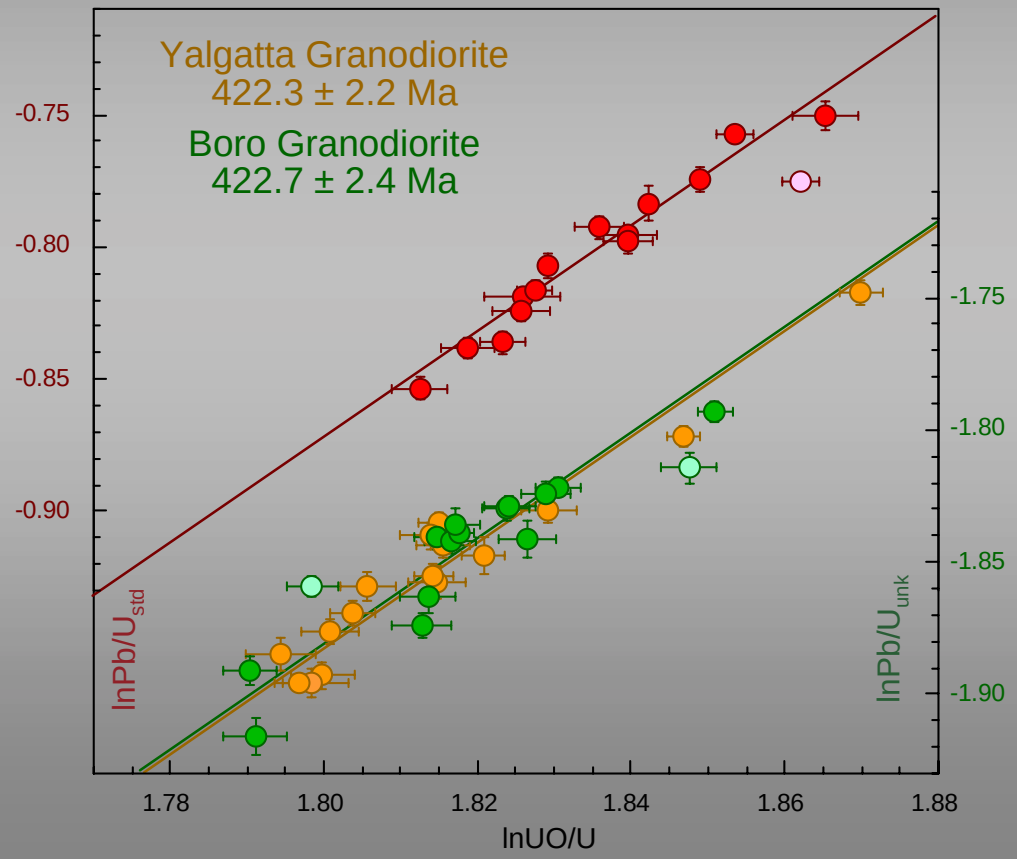
Laser Ablation ICP-MS Accuracy comparable to ^{40}Ar-^{39}Ar



Microanalysis

The question of accuracy

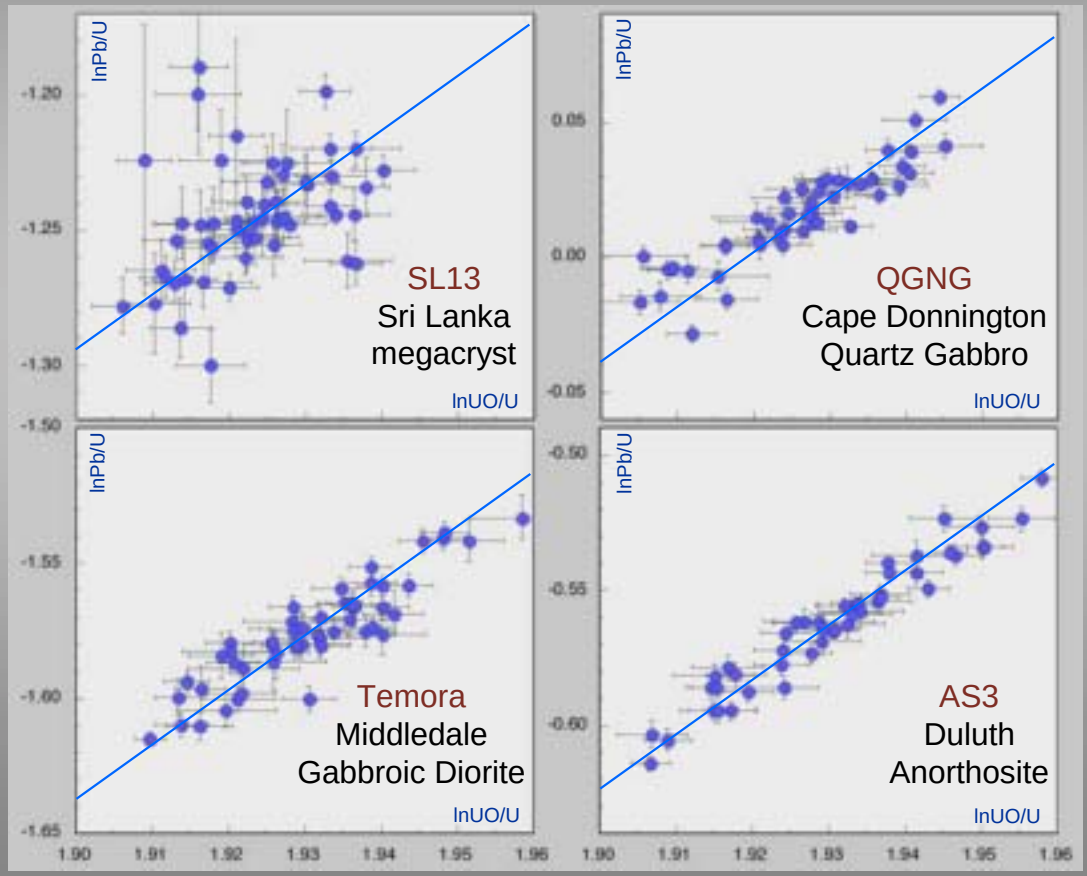
Ion Microprobe
Pb/U calibration
against
a standard



Microanalysis

The question of accuracy

Ion Microprobe Finding homogeneous standards is not easy

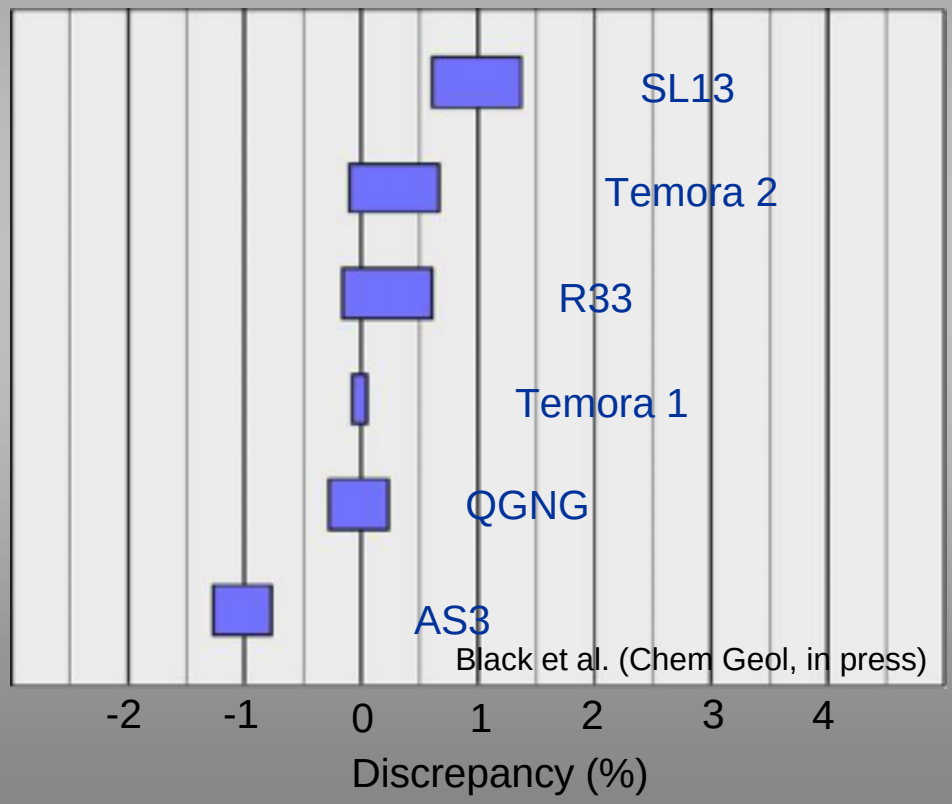


Black et al. (Chem Geol, in press)

Microanalysis

The question of accuracy

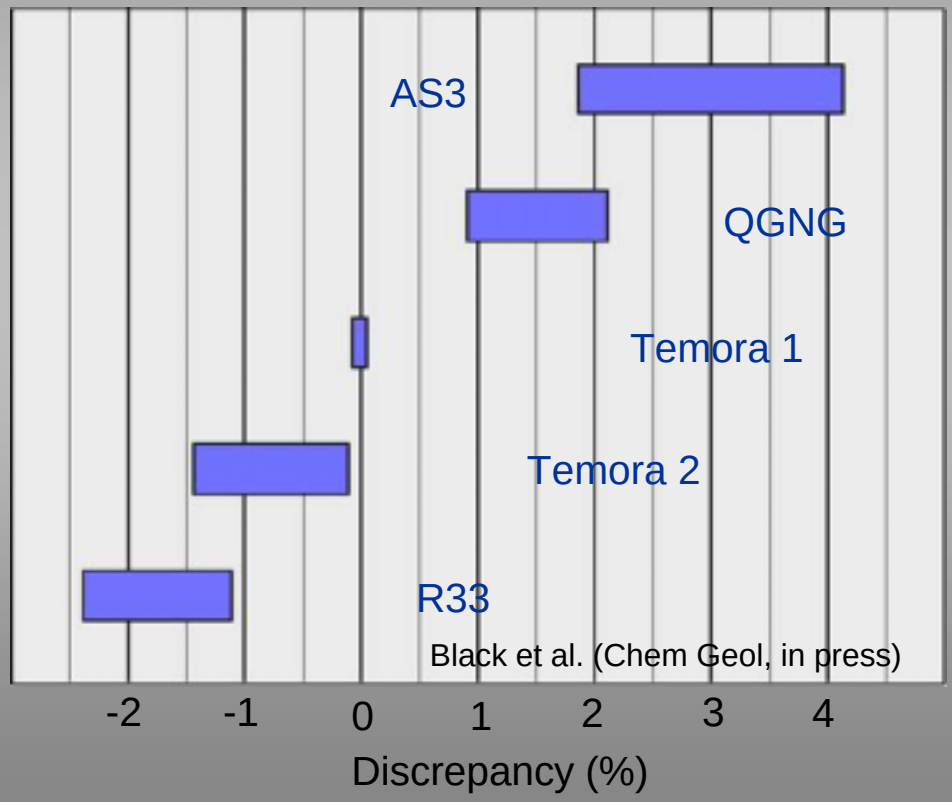
There are discrepancies between Ion Probe and isotope dilution ages at the ±1% level



Microanalysis

The question of accuracy

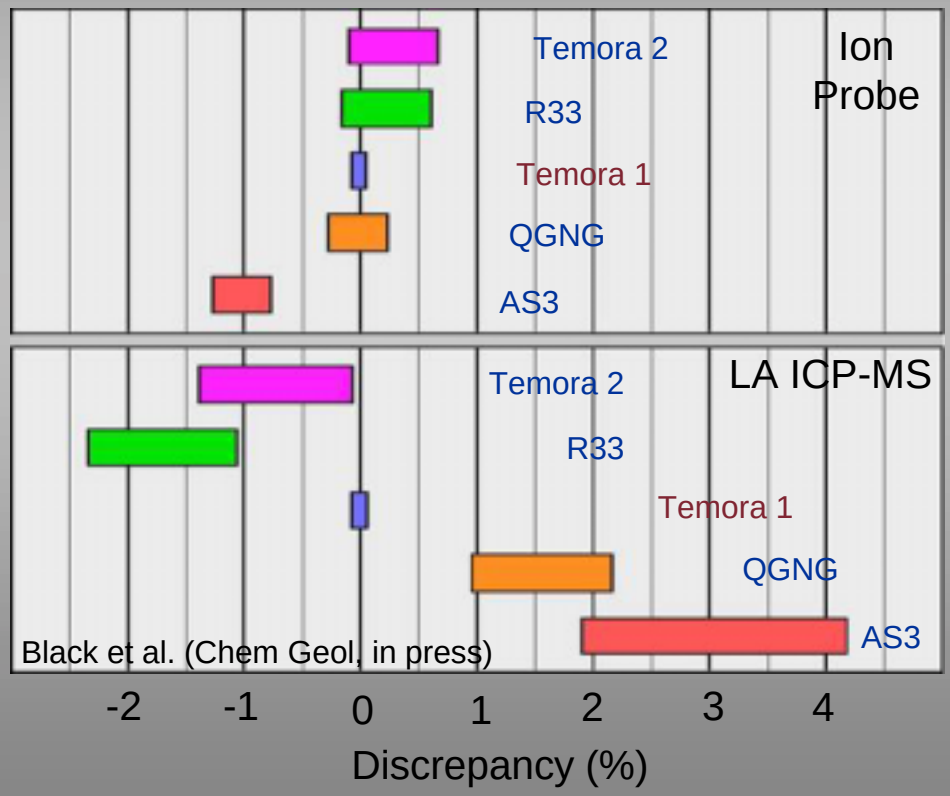
There are discrepancies between LA ICP-MS and isotope dilution ages at the ±2% level



Microanalysis

The question of accuracy

The discrepancies for Ion Probe and LA ICP-MS are not in the same direction



Meeting the challenge to get the ages right

1. Rb-Sr, K-Ar and Ar-Ar mineral ages record cooling below 500–350˚C.
2. In large batholiths, cooling below 350˚C can occur long after granite emplacement.
3. Whole rock Rb-Sr ages are imprecise, and can be inaccurate if the initial Sr isotopic composition of a magma is not uniform.
4. U-Pb Isotope Dilution analyses are extremely precise, but zircon and monazite U-Pb ages record granite emplacement only in the absence of inheritance.
5. U-Pb microanalyses are relatively imprecise, but melt-precipitated zircon and monazite can be dated free from the effects of inheritance.
6. When no inheritance is present, the uncertainty in Isotope Dilution U-Pb ages is determined mainly by uncertainty in the U decay constants.
7. The accuracy of Pb/U ages measured by microanalysis is presently limited by calibration factors to 1-3%.