^{10}Be analysis in pyroxene - a method for routine chemical extraction

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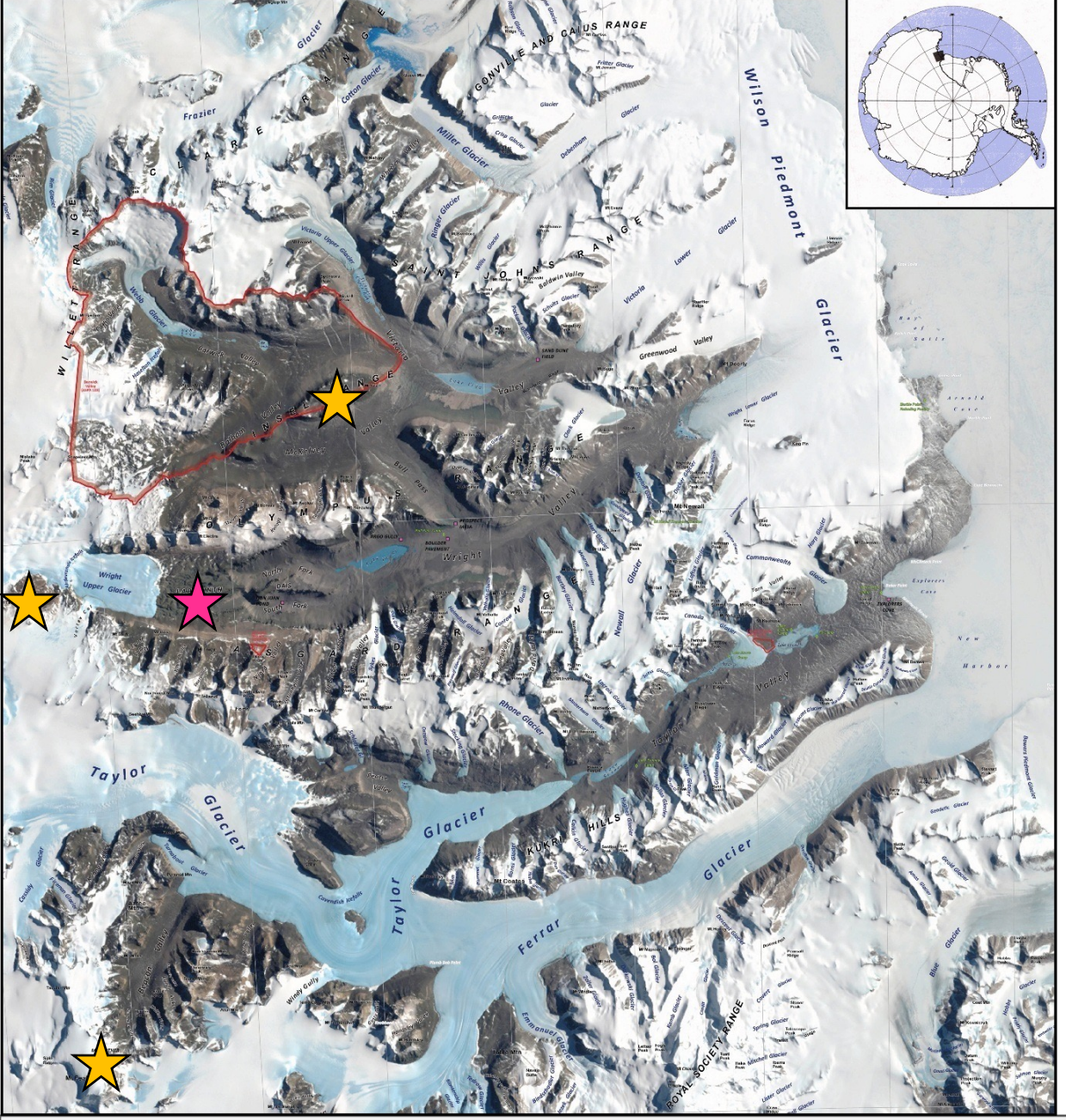
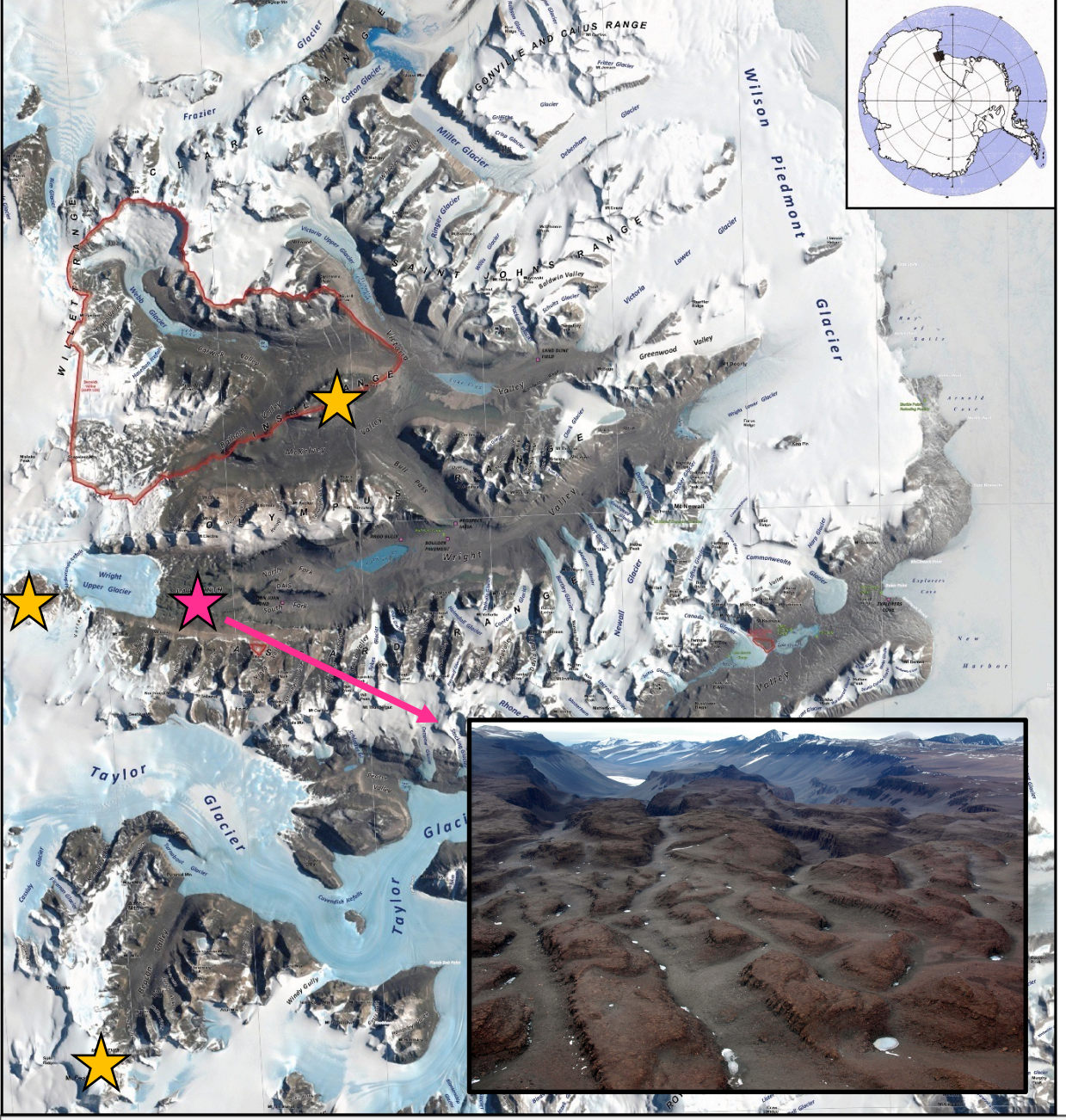


Sample locations

- 5 surface samples – SULA (Ivy-Ochs et al., 1995; Bruno et al., 1997; Schaefer et al., 1999; Schaefer et al., 2006)
  - Apparent ages 2–7 Ma
  - Erosion rate <15 cm Myr^{-1}
  - *Production rate calibration*

- 1 bedrock core – LABCO (collaboration with John Stone, Greg Balco, PH Blard)
  - Labyrinth
  - Apparent age ~1 Ma
  - Erosion rate ~40 cm Myr^{-1}
  - *Spallation and muon production rate calibration*

Map from ICYLANDS project, modified from Polar Geospatial Center



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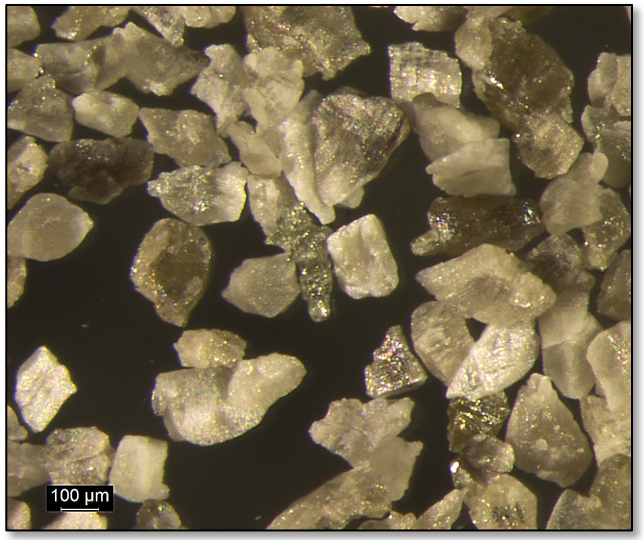
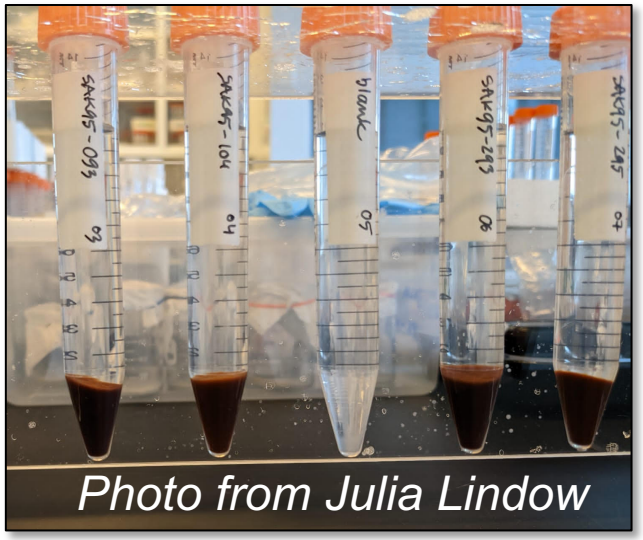
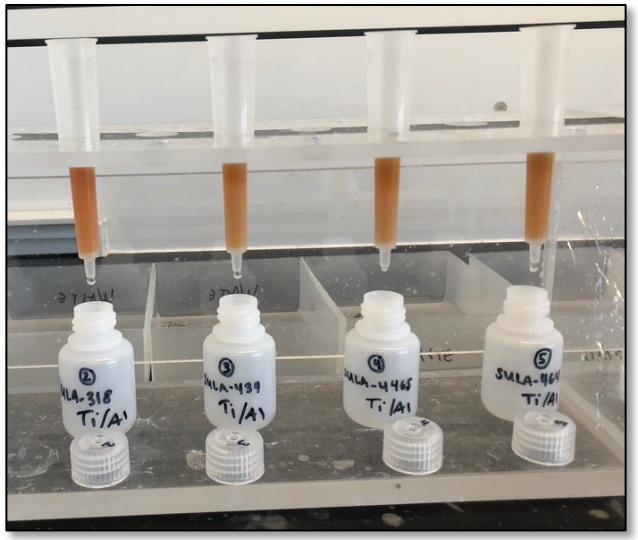
Decontamination and beryllium extraction from pyroxene

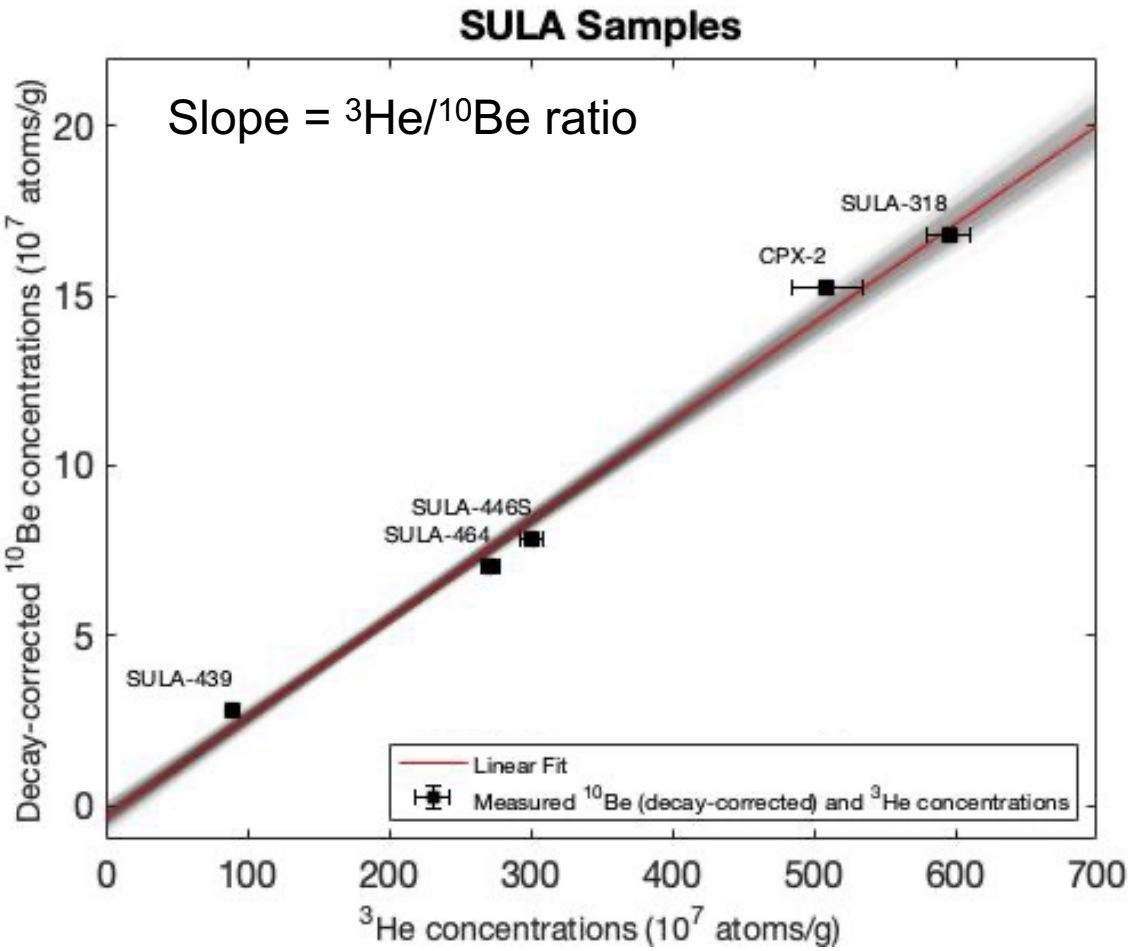
- Decontamination of pyroxene grains from meteoric ^{10}Be with **HF leaching** (Bromley et al., 2014)
- Modified from beryllium extraction from quartz - **pH 8 precipitation** before columns to remove Na, Mg and some Ca.
- Used **small sample sizes** (100–200 mg)
- Measured ratios 5x10^{-13} to 4x10^{-15} with uncertainties of <2–9% at CAMS-LLNL







$^{3}He/^{10}Be$ production ratio in pyroxene



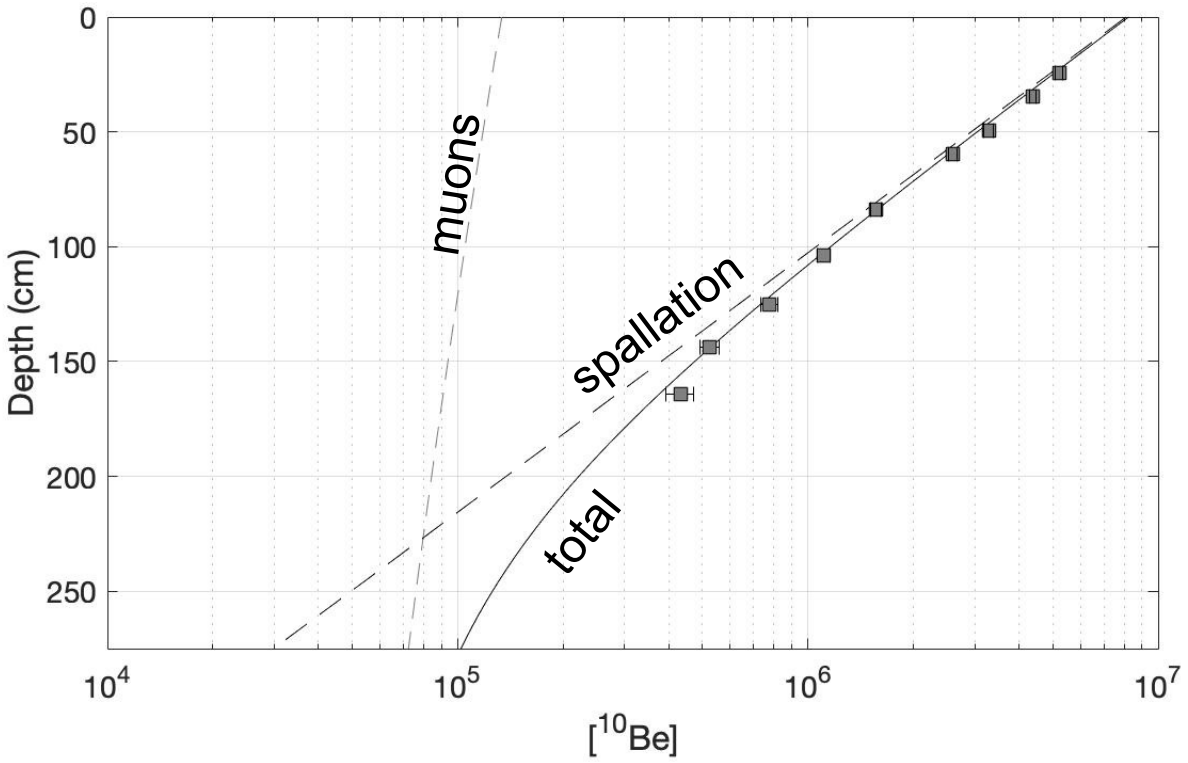
$^{3}He/^{10}Be$ ratio = 36.5 ± 0.4

^{3}He production rate = 124.03 atoms g^{-1} yr^{-1}
(Borchers et al., 2016)

^{10}Be production rate = 3.37 ± 0.30 at g^{-1} yr^{-1}

In agreement with previous estimate of 3.6 ± 0.8 at g^{-1} yr^{-1} (Eaves et al., 2018; Blard et al., 2008)

Muon production calibration and erosion from depth profiles



- Precise measurements at low ^{10}Be concentrations
- Calibrate ^{10}Be production by negative muon capture (Heisinger et al., 2002; Balco et al., 2019)
- Fitting exercise implies Labyrinth may have formed by wind erosion over 14.5 Ma (Middleton et al., 2012)

Conclusions

- **^{10}Be in pyroxene now routinely doable**, high measurement precision means young samples will be possible.
- Robust ^{3}He/^{10}Be estimate in pyroxene in line with previous estimate – **^{10}Be production rate = 3.43 ± 0.30 at g^{-1} yr^{-1}**
- Opens up ^{10}Be SED and ^{10}Be-^{3}He-^{36}Cl burial and erosion studies in pyroxenes/mafic rocks!
- **Questions/thoughts:** abalter@ldeo.columbia.edu

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Decontamination of pyroxene from meteoric ^{10}Be