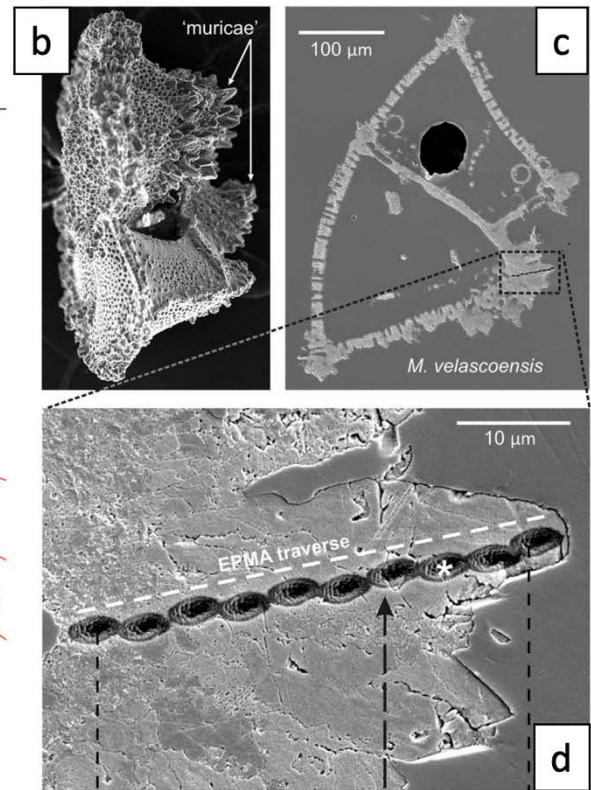
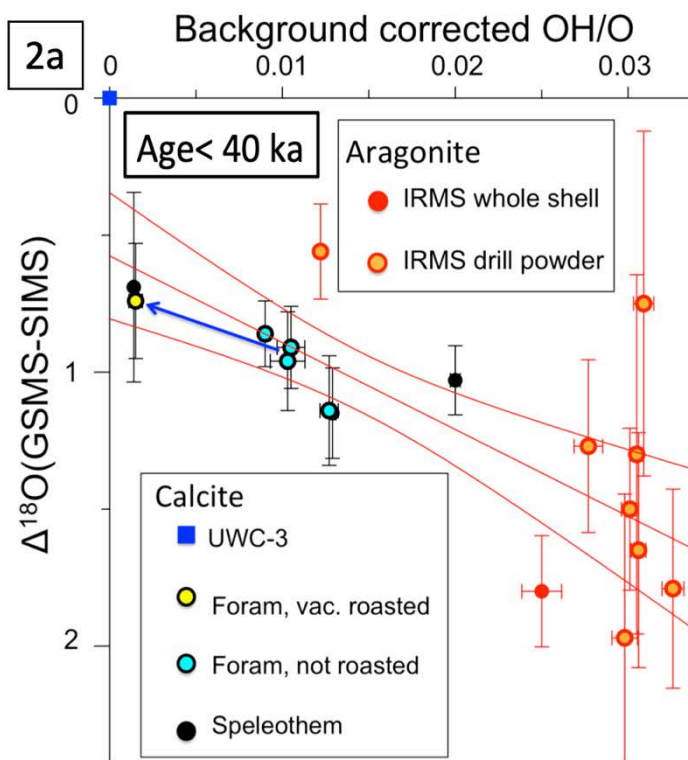
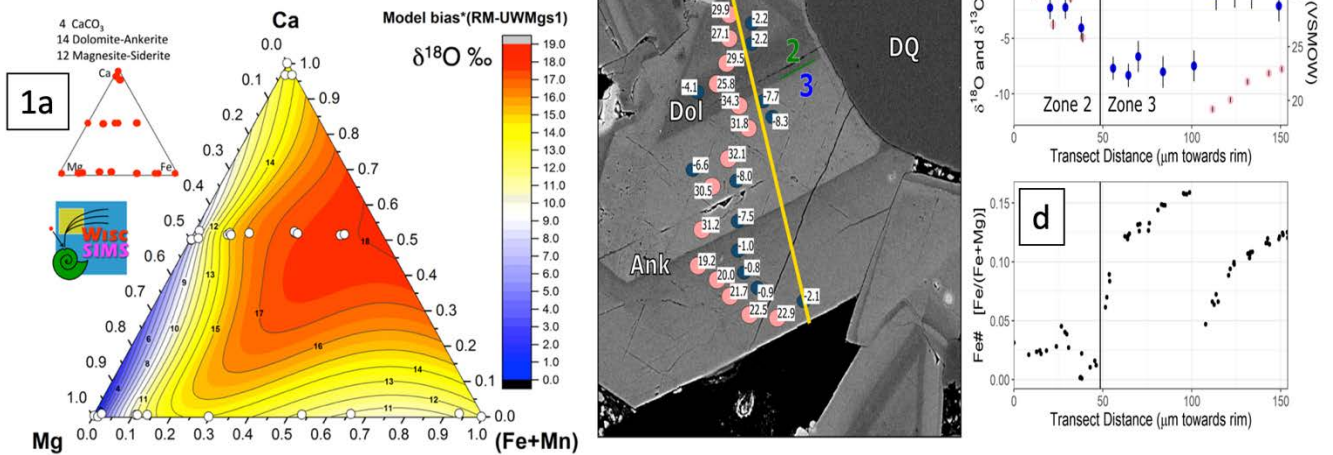


**Fig. 1.** (a) SIMS carbonate RMs, IMF (bias) for  $\delta^{18}\text{O}$  relative to calcite (Sliwinski et al. 2018, Kitajima et al. 2018). (b-d) In situ analysis of zoned carbonate cements in Bakken Fm: BSE image; SIMS (pink= $\delta^{18}\text{O}$ , blue= $\delta^{13}\text{C}$ ), EPMA (Fe/Mg). (Denny et al. 2019)



**Fig. 2.** (a) Offset of  $\delta^{18}\text{O}$  measured by GSMS vs. SIMS for young biogenic calcite and aragonite vs. OH/O (SIMS). (Orland et al. 2015) (b-e) SEM, SIMS and EPMA of calcite from a foram (marine microorganism) showing diagenetic overgrowth. Values of  $\delta^{18}\text{O}$  show constant offset that can be corrected. (Kozdon et al. 2013)

**Fig. 3.** (a) SIMS traverse (6yr~2mm) of Pacific Cod otolith. (a)  $\delta^{18}\text{O}$  and OH/O by SIMS. (b)  $\delta^{18}\text{O}$  by SIMS vs.  $\delta^{18}\text{O}$  by GSMS. The offset is variable and correlates to OH. (Helser et al. 2018)

