

Supplemental handout for NMGS 2026 Day 1 basement stops (KE Karlstrom)

- **Main points:** keyed to walking stops along the Jaral Trail and sketches herein
- Overview: Sandia pluton is a 1.45 Ga pluton that was intruded at ~ 10 km depth. This trip looks at its northern aureole with older country rocks. Its southern margin is the Sven Springs shear zone; Its roof is on the back side of the Sandias where granite intruded quartzites and schist.
- 1A and all stops: Bedding is still recognizable in the northern contact aureole of the Sandia pluton in what is likely Blue Springs Schist and interbedded quartzite of the Manzano Group
- 1B: Migmatites (descriptive term for “mixture”) as mixed igneous+metamorphic schists and gneisses that form as injection migmatite AND partial melt migmatite and their interaction during melt flux
- 1C. Mixed veins/dikes of quartz (hydrous) + pegmatite (silicate melt) represent last fluids to crystallize; there was likely melt present from 1.45 to 1.43 Ga, with some 1.43 dikes being tabular and undeformed
- 1D: Tectonic concepts: fold (F) and fabric (S for schistosity of surface) generations (relative ages) can be “dated” by inferring 1.45- 1.43 Ga age of partial melt and 1.43 Ga age of crosscutting tabular pegmatite dikes that truncates the schistosity in the aureole that is often a composite S0/S1/S2 foliation.
- 2A: Isoclinal folds of bedding are called F1– they could have originated during a first deformation (D1) in the 1.65- 1.60 Ga Mazatzal orogeny but are now involved with partial melt in the **FLOWING** 1.45-1.43 Ga aureole deformation of the pluton during the D2 1.48-1.35 Ga Picuris orogeny
- 2B: F2 folds refold F1 folds and melt pods and formed during pluton emplacement
- Recap by KK on the way out: The 1.45 Ga (U-Pb age) Sandia Granite (within the pluton) is only weakly deformed yet the aureole is a **FLOWING MASS OF MIGMATITE**. Granite textures at La Cueva picnic area showed some magmatic fabric and aligned enclaves documenting magma mingling and flow during emplacement when the magma was a **RHEOLOGICAL “FLUID”**. Variable but generally weak solid-state deformation is locally visible in the quartz of the granite’s matrix
- The concept of **critical melt fraction** is that crystallizing magmas (consisting of crystals plus melt) change from **“fluid” melt to “solid” rock** when crystals become abundant enough to clog the flow. This is about 70% crystals for most granites but there is still melt present and possibility for flow of melt between crystals and resulting melt flux down to about 5% melt fraction.



Stop 1A) shows partial melt textures in migmatites-- the country rock was heated to about 650 C and started to **partially** melt – leucosome (light stuff is partial melt) and melanosome (biotite- rich residue or selvages – concentrations around veins and grain boundaries. Melt reactions include biotite dehydration melting and fluid-flux melt reactions



Stop 1B) Lineated partial melt textures have leucosome (light stuff is partial melt) and melanosome (biotite streaks and residual stuff) that record the partial melting products are lineated in the local flow direction indicating this was all a flowing mass of rock, heated by the pluton from 1.45-1.43 Ga



2C) Zoned pegmatites like this one suggest an evolution of fluid flux through this dike—probably mostly melt first, then mostly hydrous fluid in the center as the dike widened and crystallized. Look for the tourmaline in the outcrop in the wash just up from this one



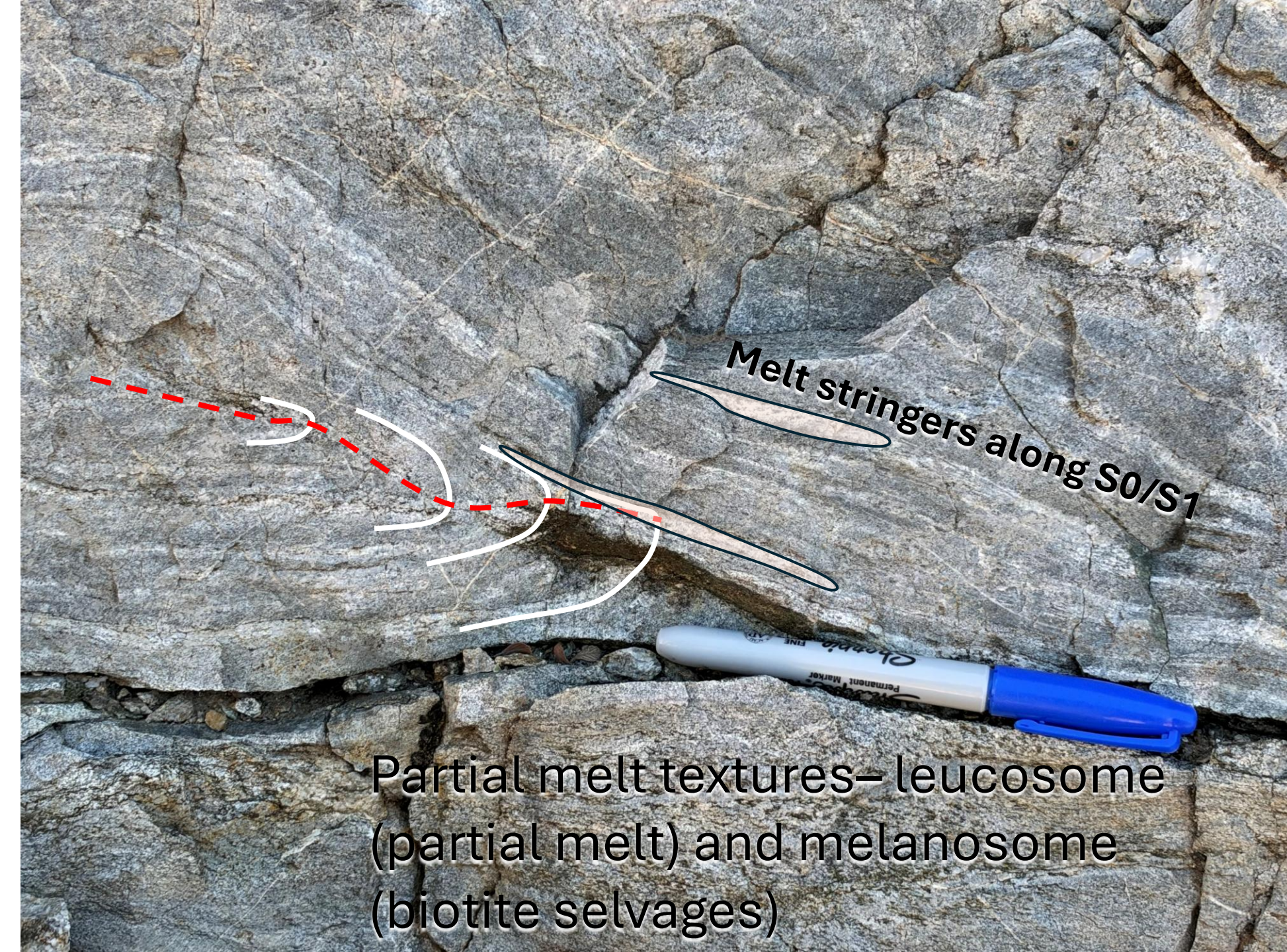
2A) Water Fall outcrop”

Fold in quartzite layers
of Blue Spring Schist.
Simple S-fold? or faulted
fold?

What is fold axis?
Structure pics are
supposed to be taken
looking down FA

What is Axial Plane—red
line between 2 limbs is
subparallel to most of
foliation in this aureole
(see stereonet)

S-fold suggests
combination of
shortening and left-
lateral shearing



Melt stringers along S_0/S_1

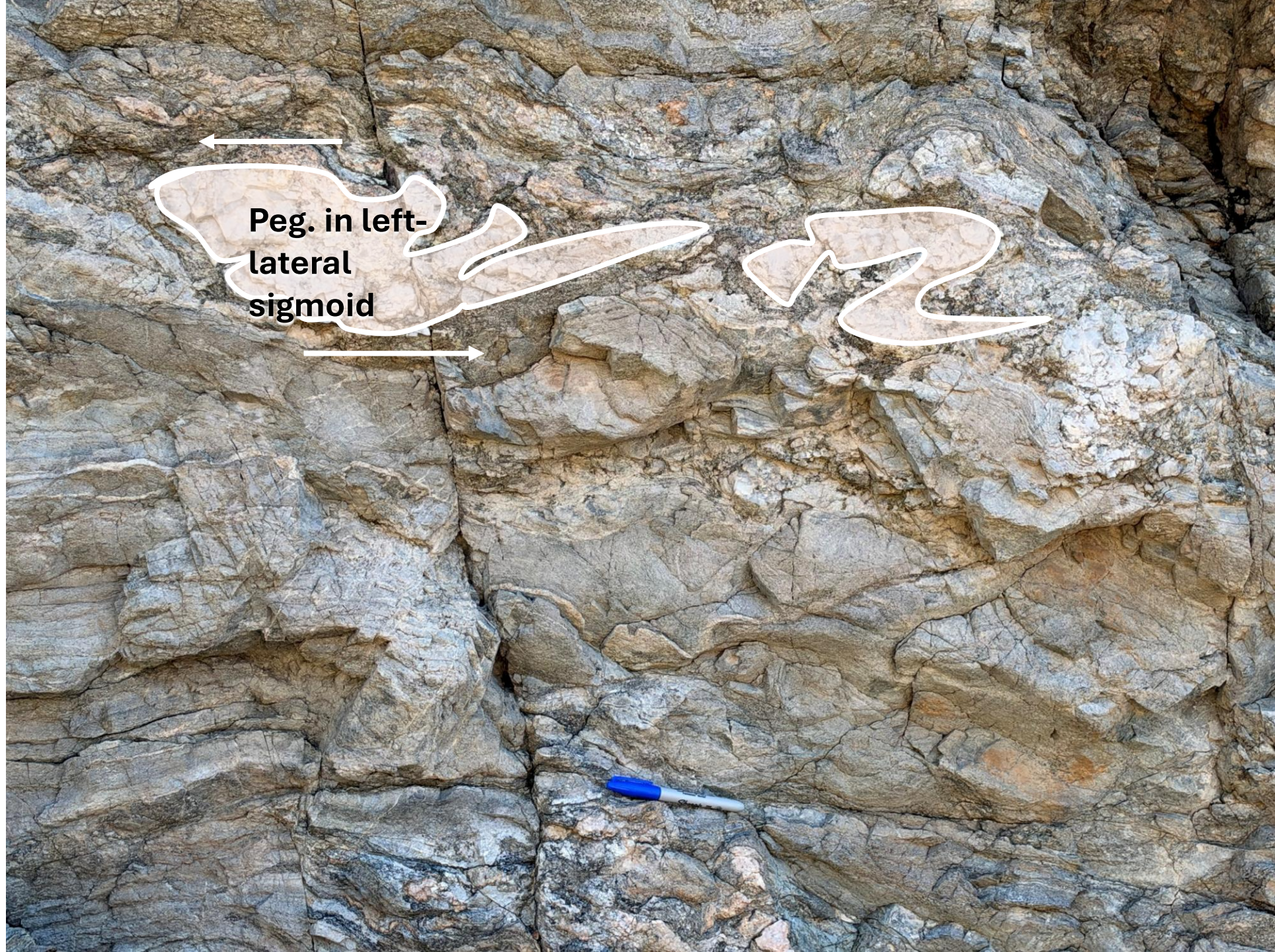
2B-1 bedding and folds
and partial melt

Partial melt textures—leucosome
(partial melt) and melanosome
(biotite selvages)



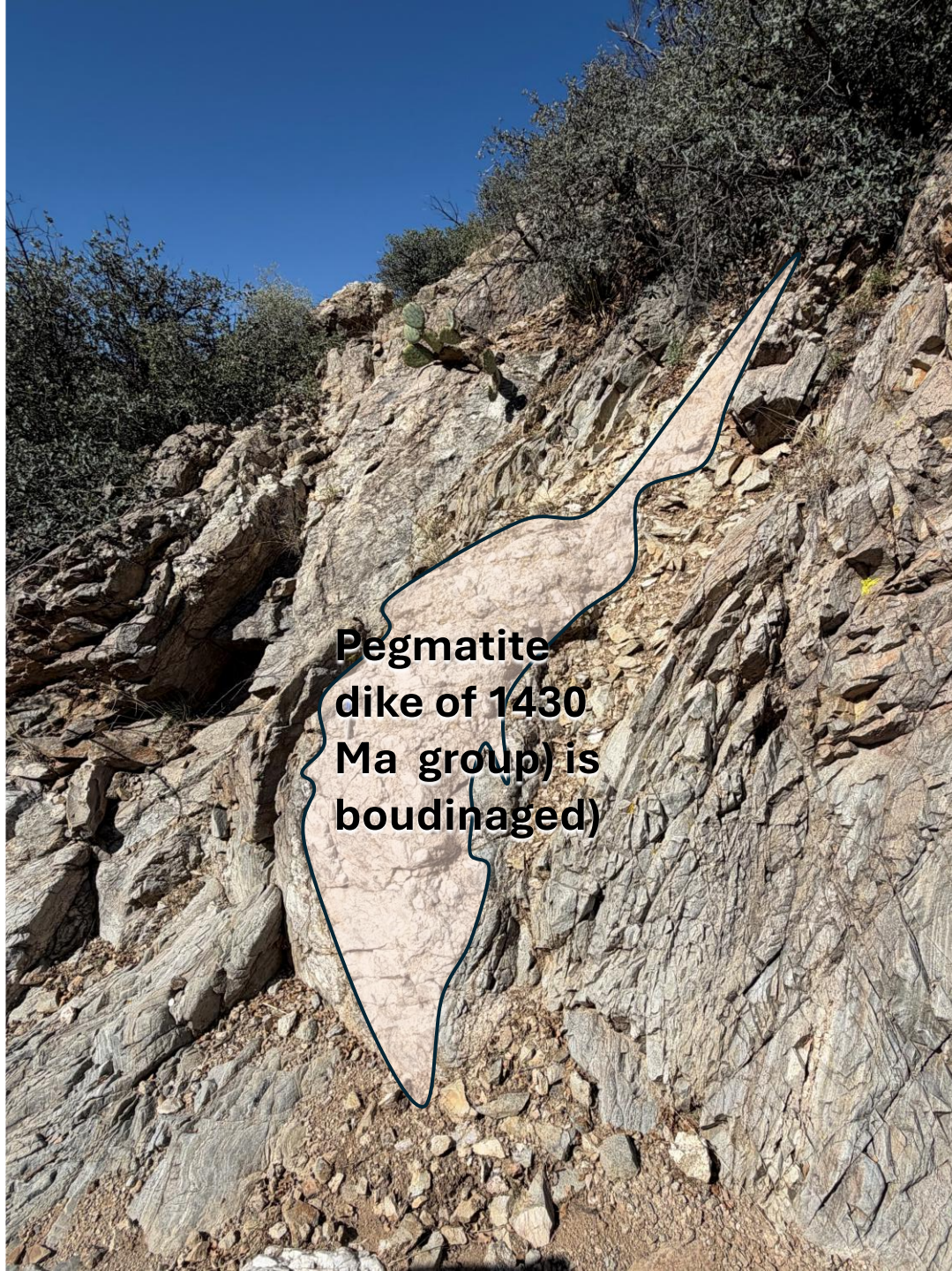
2B-2) below waterfall
outcrop

Axial planes of F2 folds are S2 (yellow planes that connect F2 hinge regions); note how they “die out” against mylonites (V. fine gr layers) indicating grain-size reduction outlasted F2 as aureole cooled. S2 may also “die out” at melt pods (circle) indicating the same thing as melt is present during F2 and may facilitate layer parallel shear. Note that apparent shear sense is right lateral in this zone—indicating complex flow in the aureole (other outcrops have indicated mostly right later shear on S0/S1)



**Peg. in left-
lateral
sigmoid**

2B-3 folded
and
boudinaged
pegmatite



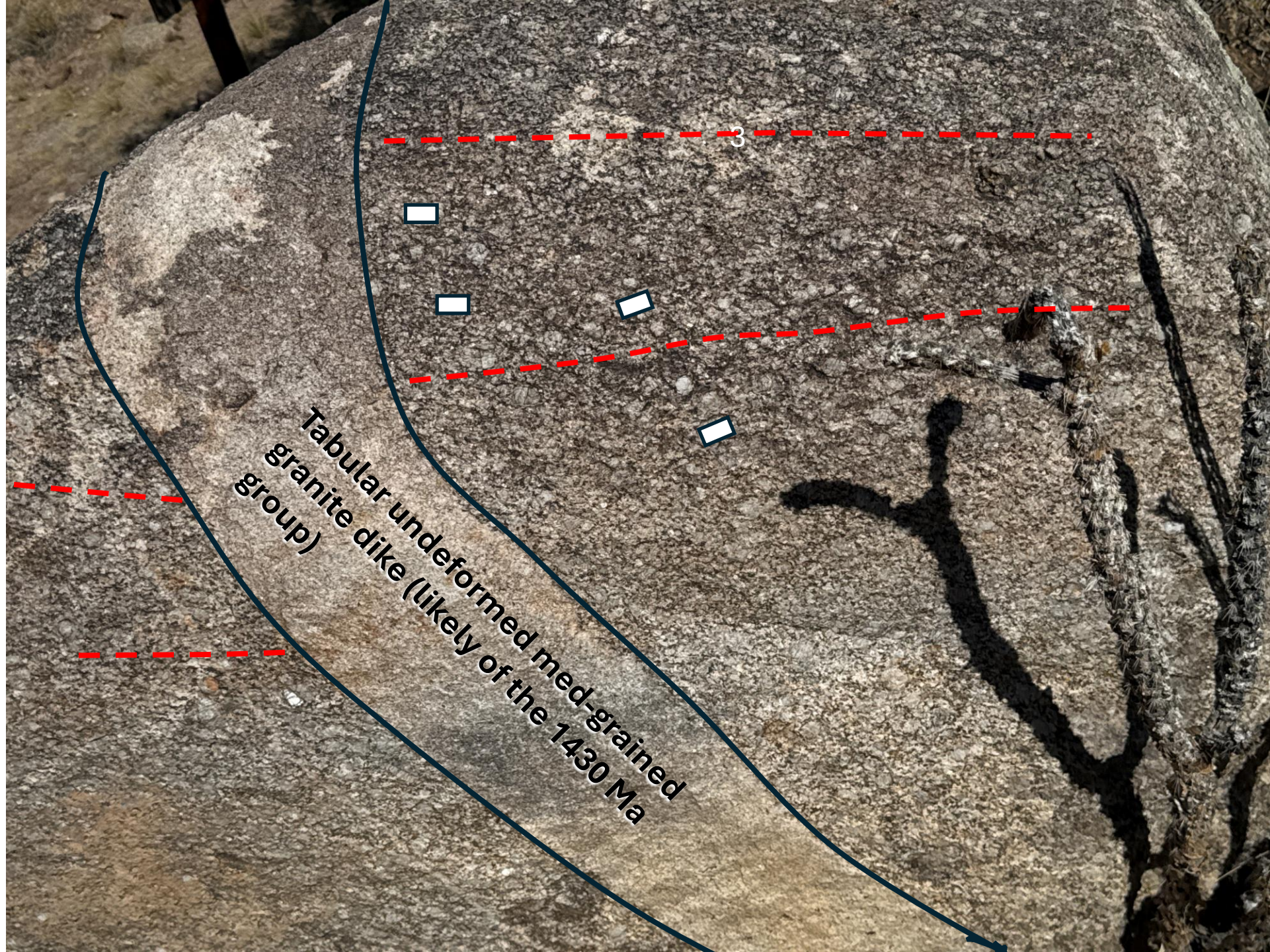
**Pegmatite
dike of 1430
Ma group) is
boudinaged)**

3) Pegmatites crystallize quickly and then change from fluid/ melt mix to a solid in “blink of an eye” ; then they start to crack because they do not have enough mica or layering to help deform ductilely on the inside)





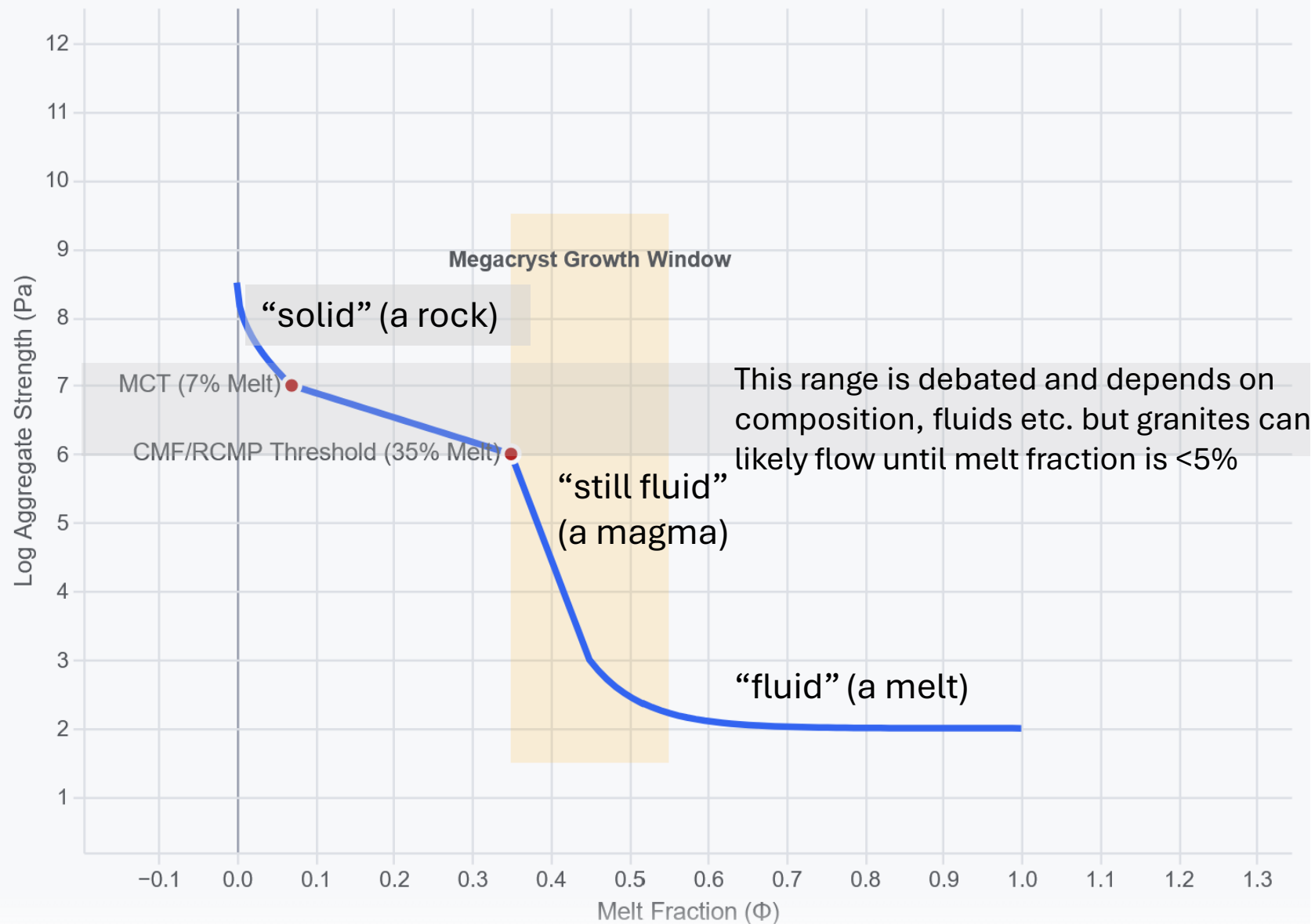
Stop 3- Pegmatite outcrop in adit on high trail – likely of 1430 Ma group, is mainly quartz (quartz veins represent late hydrous fluids) with some pegmatite (silicate melt traveling with late hydrous magmatic fluid). Boundinage in pegmatite shows SW-up offsets. Inset shows same shear sense in fragmented and folded sigmoidal pegmatites



KK recap: Tabular undeformed med-grained granite dike (likely of the 1430 Ma group) crosscuts magmatic flow fabric (red) in megacrystic 1450 Sandia granite near La Cueva picnic grounds

The magmatic flow fabric in the granite is about the same age as the complex migmatization and flow in the contact aureole of the granite and both reflect regional stresses of the Picuris orogeny

Rheological Transitions and Aggregate Strength in Granitic Magma



Modified from Rosenberg, C. L., & Handy, M. R. (2005). Experimental deformation of partially melted granite revisited: Implications for the continental crust. *Journal of Metamorphic Geology*, 23(1), 19-31.