ROCK-MAGNETIC STUDY OF THE WALLOWA BATHOLITH

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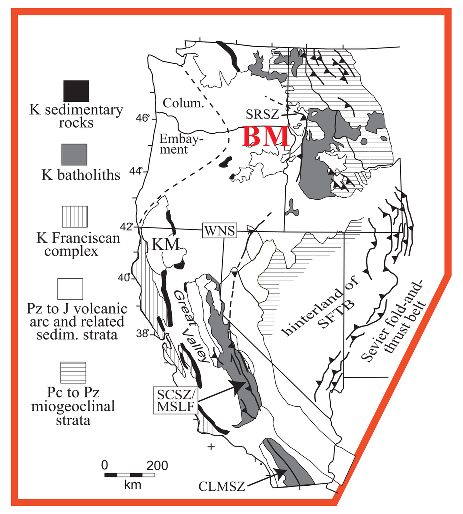
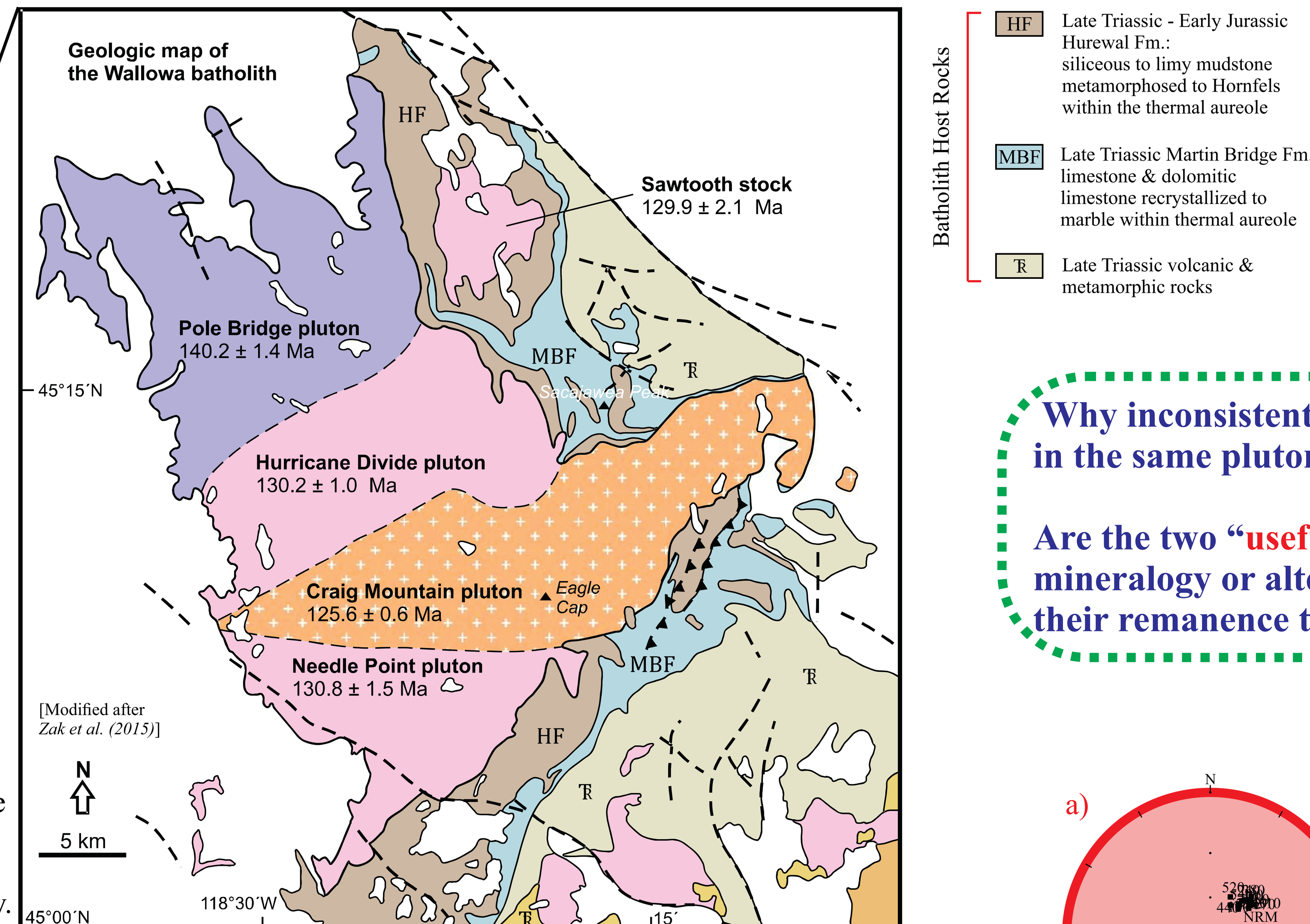
Blue Mountains Province – why study it?



The extent and timing of translation and or rotation of allochthonous terranes, including the Blue Mountains (BM) before, during and or after their docking with North American palte along the arc-continent boundary is still a matter of debate.

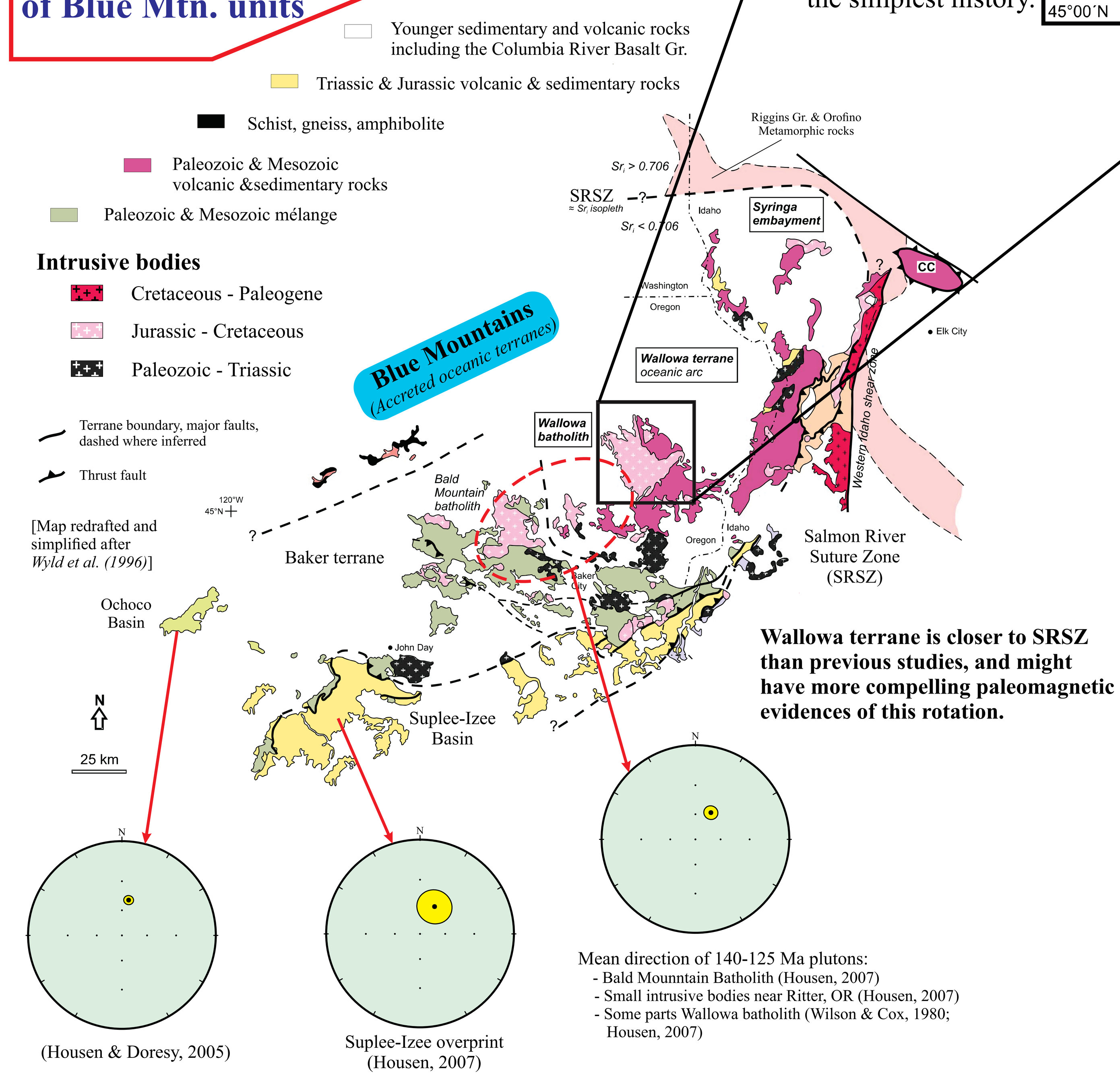
Despite the results from Wilson & Cox (1980) and etc, which are consistent with CW rotation, paleomagnetic results from the plutons may be uncertain due to lack of paleohorizontal (tilt is possible) and also there are other complicating factors such as cooling and magnetization during differential uplift.
Therefore, understanding the origin of magnetic minerals and thermal history of plutons are important and helpful.

We used specimens from the late Jurassic – early Cretaceous Wallowa batholith provided by the authors of Zak et al. (2012; 2015).

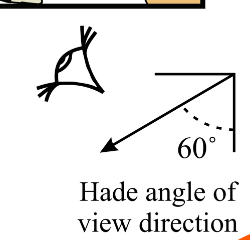


We studied the youngest pluton, Craig Mtn, because it seemed most likely to have the simplest history.

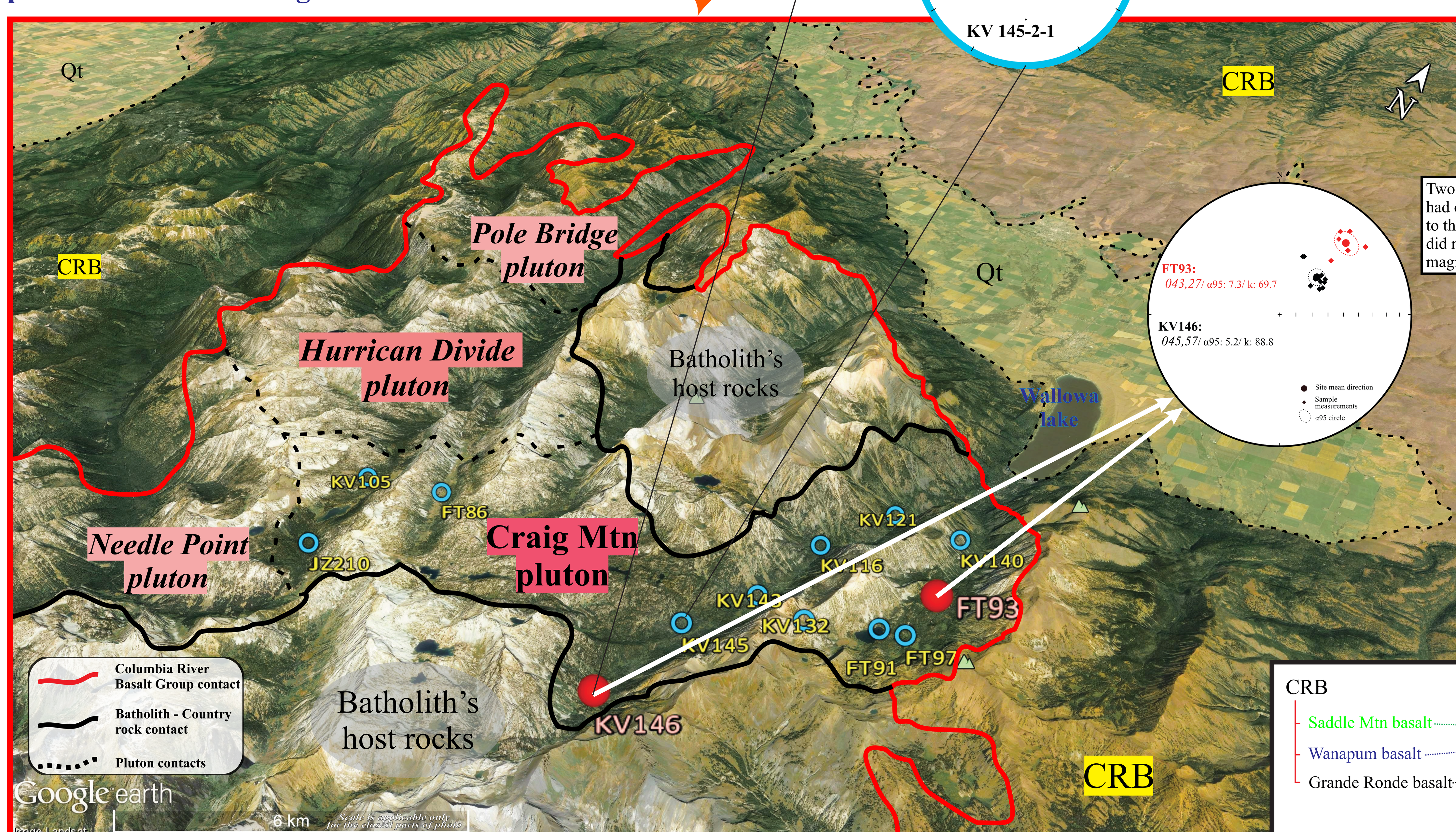
Wallowa batholith and its relationship with the rest of Blue Mtn. units



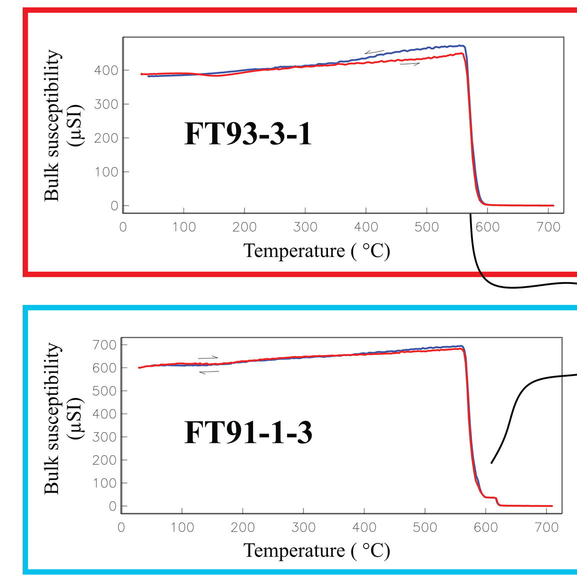
Blue Mtn trend is at high angle to the NNW-SSE North American plate boundary, consistent with CW rotation due to dextral shearing during or after accretion of the terrane ~140 Ma, and consistent with previous paleomagnetic results (e.g. Wilson and Cox, 1980; Housen and Doresy, 2005).



Oblique Google earth view of Craig Mtn pluton and surrounding units



Two sites (FT93 and KV146) had coherent directions down to the NE, but adjacent sites did not have coherent magnetizations.



Thermomagnetic curves indicate sharp drop at magnetite Curie temperature (~580°C).

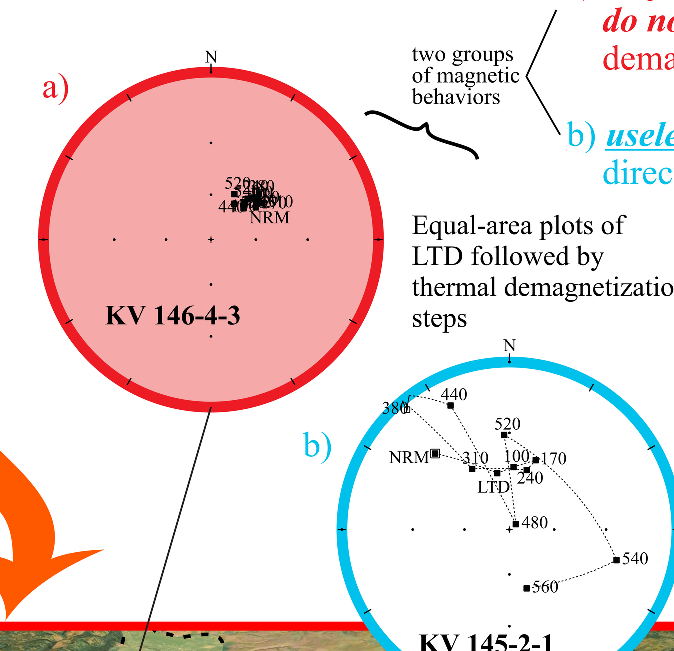
Why inconsistent results from neighboring sites in the same pluton?

Are the two "useful" sites different in magnetic mineralogy or alteration history that allowed their remanence to survive?

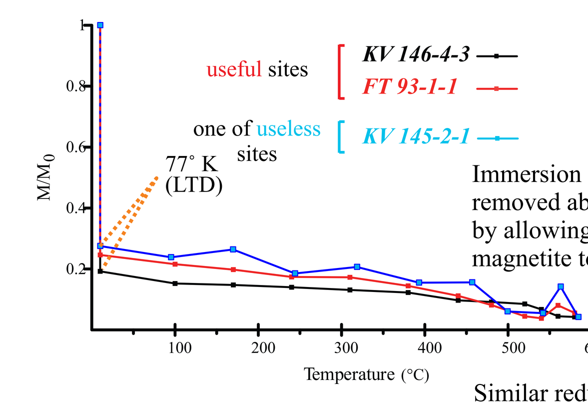
We looked at magnetic mineralogy using magnetic methods and silicate mineralogy using x-ray diffraction.

a) *useful* magnetization paths (well-resolved) for tectonic studies *do not change* directions with reduction in strength during demagnetization

b) *useless* magnetization paths (poorly-resolved) *change* directions erratically with demagnetization



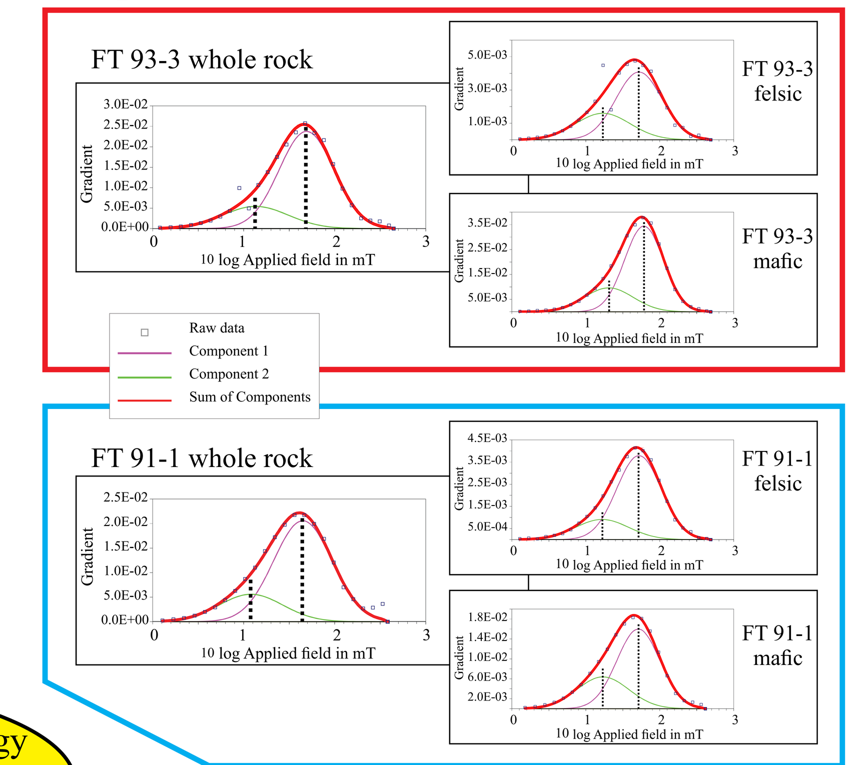
Equal-area plots of LTD followed by thermal demagnetization steps



Immersion in liquid nitrogen (LTD) reduced about 80% of remanence by allowing domain walls in MD magnetite to move.

Similar reduction of remanence with alternating field demagnetization is consistent with bulk of remanence held by multidomain magnetite

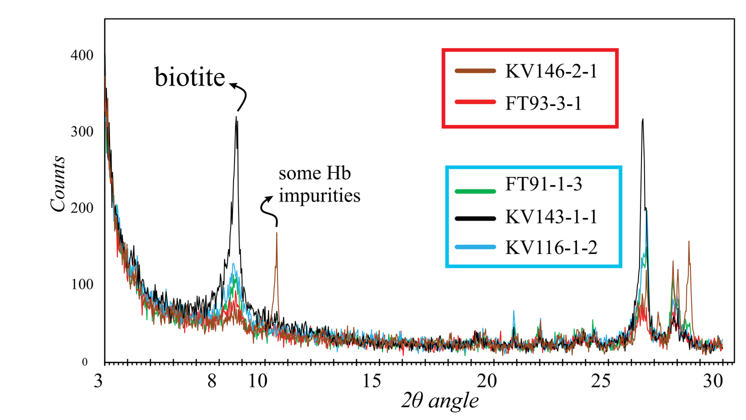
Gradient Acquistion Plots *(Kruiver et al. 2001)*



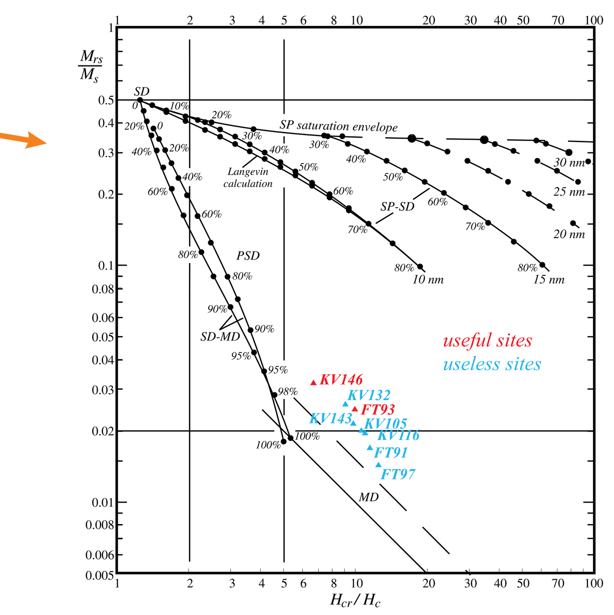
IRM decomposition curve fitting results of representative samples from both *useful* and *useless* sites, along with their felsic and mafic (mostly mica) fractions are showing two grain populations with overlapping coercivities.

The peaks are around **12 mT** and **45 mT** for low and moderately high coercive components.

Contribution proportions and peak fields of these two populations are very close to each other. Aslo similar are results from whole-rock and felsic versus mafic fractions suggesting the populations of magnetite are uniformly distributed within samples and also are similar in all sites.



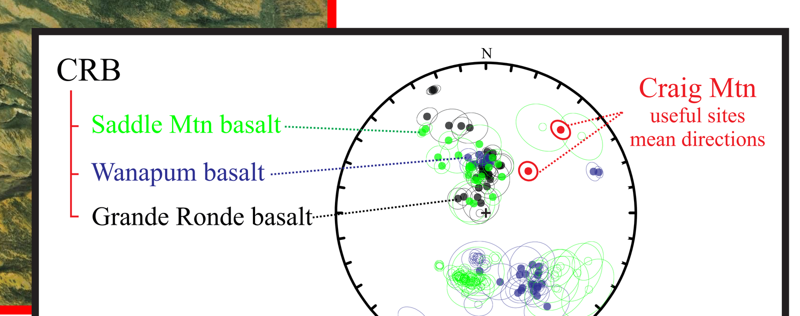
Clay mineralogy investigations of phyllosilicates (XRD results) indicate no significant alteration or differences between sites.



Day plots also show large contribution of MD and PSD magnetite grains to both groups.

Conclusions

- *Useful* (well resolved) site mean directions are down to the NE, with significantly different inclinations, perhaps due to pluton tilting.
- Low Temperature Demagnetization (LTD), Day plot, and thermomagnetic susceptibility curves indicate that the main remanence carrier is multidomain magnetite.
- We did not find any differences in magnetic mineralogy or evidence of altration that would account for preservation of an original magnetization in just the two *useful* sites or natural demagnetization in the *useless* sites.



[CRB site mean directions compiled from supplementary dataset presented by Dominguez & VanderVoo (2014)]

Remaining Questions:

- If there is no differnce except remanance, could mechanism be one of remagnetization not retention?
- Local magnetization?
  Possible remagnetization of useful sites by younger igneous events, but no CRB flows have similar directions.

  Possible alteration of finest-grained magnetic phase from local fluids(?), but no effect on bulk mineralogy(?)
- Post-collection remagnetization?
  Samples were shipped across the Atlantic twice and studied in Europe, so their exposure to high magnetic fields is unknown.