Locating the Westminster-Potomac Terrane Boundary in the Maryland Piedmont Province

By Jennifer Collins

Advisors: Dr. Aaron Martin, Dr. Phil Piccoli

1.Hypothesis

Before Wintsch's study in 2010, the terrane boundary between the Westminster and Potomac terranes was accepted to be the Pleasant Grove thrust fault (see figure 2). Wintsch found that the white micas in the rocks of these two terranes differed in age by 60 Ma by using the closure temperatures of argon diffusion. Ages of the cleavages in rocks within the Westminster and Potomac terranes were determined using $^{40}Ar/^{39}Ar$ analysis of micas. In the western part of the Westminster terrane, cleavages are Early Silurian in age; and in the eastern part of the Westminster terrane and western Potomac terrane, cleavages are Late Devonian in age (Wintsch, 2010). From these cleavage domains, Wintsch proposed that the Parrs Ridge thrust fault is the terrane boundary between the Potomac and Westminster terranes. I hypothesize that detrital zircon U/Pb age signatures and microstructural analyses will indicate that the Parrs Ridge fault is the boundary between the Westminster and Potomac terranes.

2.Geologic Setting

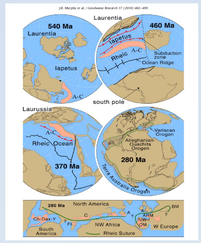

Figure 1

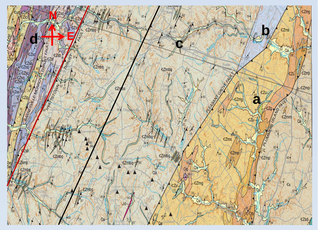

Figure 2

Figure 1: Schematic of the open and close of the Iapetus and Rheic Oceans from Murphy et al., 2010). **Figure 2:** Map of the northern Maryland region from Southworth et al., 2007. From east to west the formations sampled are the (a) Mather Gorge Fm., (b) Prettyboy Schist, (c) Marburg Fm. (east and west of the proposed Parrs Ridge fault), and (d) Sams Creek Fm. Black line=Parrs Ridge thrust fault, red line=Hyattstown thrust fault. West of the Parrs Ridge fault is the Westminster terrane, and to the east is the Potomac terrane.

3. Thin Sections

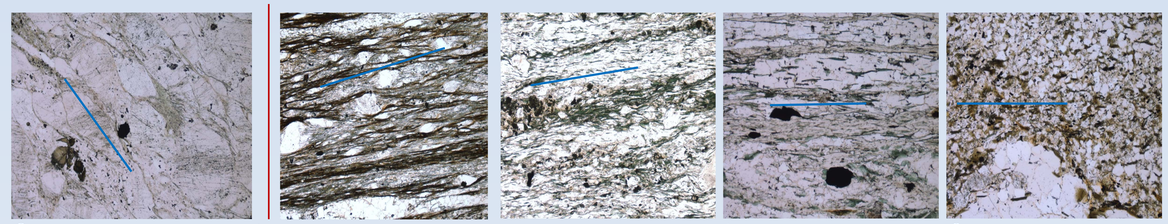

Figure 3: Photomicrographs of formations sampled from west to east: a) Sams Creek Fm., b) W. Marburg Fm., c) E. Marburg Fm., d) Prettyboy Schist., e) Mather Gorge Fm. All taken at 5x (2.7mm field of view), in plain polarized light. Blue lines indicate approximate orientation of foliation. Red line indicates boundary between east and west samples.

4.U/Pb Geochronologic data

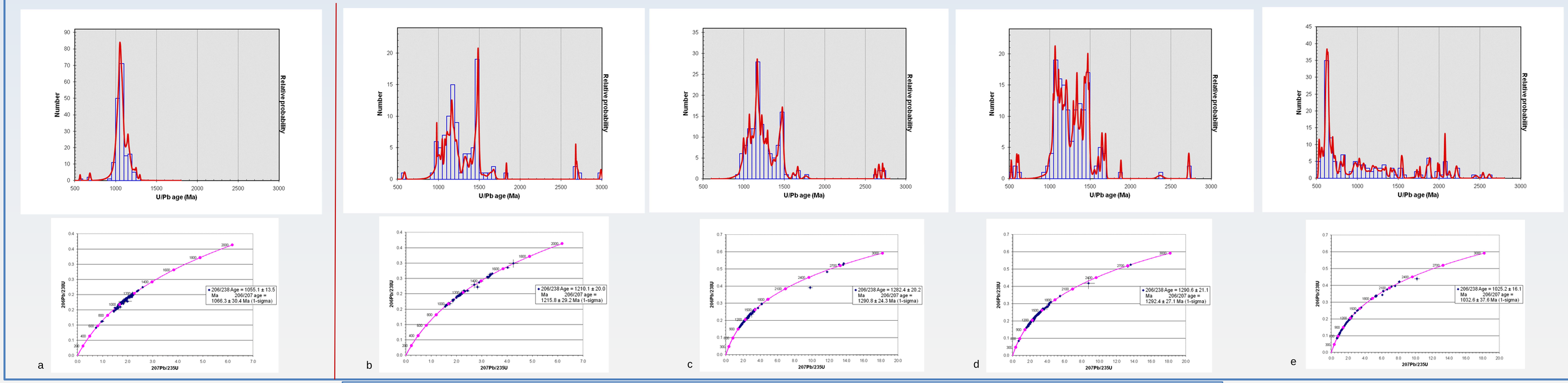

Figure 4: Relative probability and concordia plots of the formations sampled in this study. In order from west to east: a) Sams Creek Fm., b) W. Marburg Fm., c) East Marburg Fm., d) Prettyboy Schist, e) Mather Gorge Fm. Red line indicates boundary between western and eastern type formations.

5. Discussion

- Observation of thin sections suggests that there is no mineralogical or structural boundary between the east and west Marburg Fm., despite minor differences between these two samples.
  - Eastern-type samples exhibit similar mineralogy and orientation of foliation. Contain >25% micas and pyrite; exhibit ~NE-SW foliation.
  - Western-type sample contains <10% mica and almost no pyrite. Exhibits ~NW-SE foliation.
- One U/Pb age population (~900-1300 Ma) is observed in western-type formations, while eastern-type rocks exhibit a wide range of U/Pb age populations, from ~650-2000 Ma.
- The preceding observations suggests that the Westminster-Potomac terrane boundary is located along the Hyattstown thrust Fault, which separates the Marburg Fm. from the Sams Creek Fm.

6. Implications

1. The formations within the Westminster terrane had one source, similar to that of the Blue Ridge Anticlinorium, which contains zircons that exhibit U/Pb ages ranging from ~570-2000 Ma.
2. The Potomac terrane has not been displaced, and was located on Laurentia along with the Westminster terrane.
3. The Potomac terrane was located where Newfoundland in eastern Canada is located today.
4. The Potomac terrane was located on the western portion of Gondwana, and was transferred onto the Laurentian margin, colliding with the Westminster terrane.

7. References

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