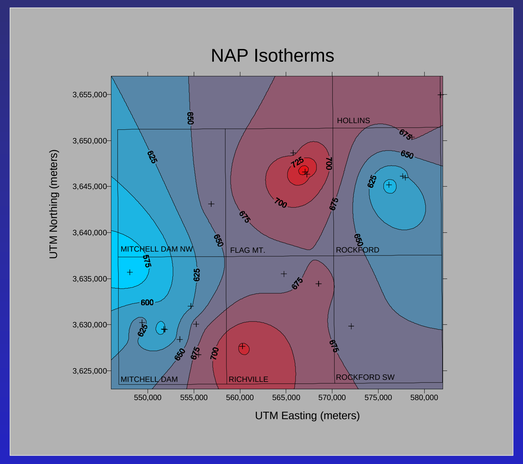
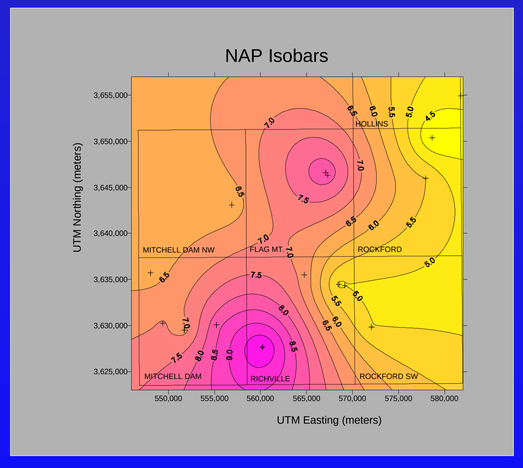
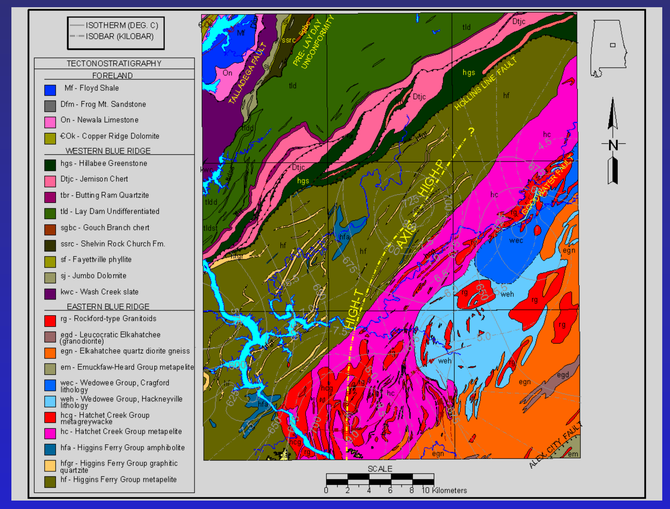
DEFORMATION OF ACADIAN GEOTHERMOBAROMETRIC TRENDS BY ALLEGHANIAN STRUCTURES: TWO CASE STUDIES FROM THE SOUTHERN APPALACHIAN BLUE RIDGE



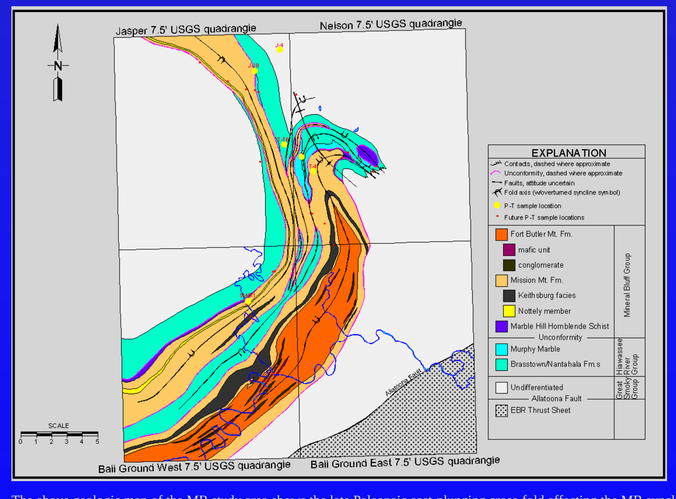
Contours of temperature estimates for NAP prograde samples. Note the temperature "highs" trending along a NE-SW axis through the Richville and Flag Mt. quadrangles. Sample locations are indicated by the cross symbols.



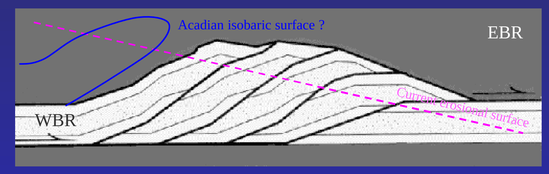
Pressure estimates from NAP prograde samples define a high pressure axis trending NE-SW through the Richville and Flag Mt. quadrangles. This trend is essentially equivalent to the above high temperature axis. The axis is sub-parallel to regional strike in this region (see geologic map).



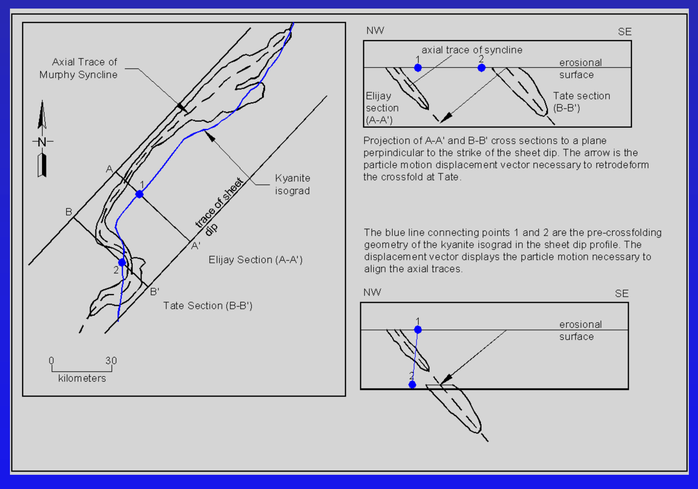
The above geologic map of the NAP study area is superimposed with contours of T and P to delineate the high T-P axis relative to tectonostratigraphy. The Hollins Line Fault separates lower greenschist facies lithologies of the western Blue Ridge Talladega Belt (northwest) from upper amphibolite facies rocks of the eastern Blue Ridge Ashland-Wedowee belt (southeast). A major footwall duplex structure is present below the Hollins Line roof thrust. We speculate that uplift associated with a footwall duplex ramp may explain the high T and P axis geometry detected within the EBR roof thrust.



The above geologic map of the MB study area shows the late Paleozoic east-plunging cross-fold affecting the MB synclinorium. T-P estimates from the core of the cross-fold (T-5B, T-3, T-4) indicate elevated T and P values compared to other samples in the MB. We believe that Acadian isothermal and isobaric surfaces were folded by the Alleghanian cross-fold, exposing samples with elevated T-P in the core of the cross-fold. The adjacent diagram to the right explains the geometry of the cross-fold structure in more detail.



We speculate that the EBR roof thrust ramped over the Hollins Line footwall duplex to fold isothermal and/or isobaric surfaces (blue line) into an antiformal geometry. The current erosional surface (dashed line) has exposed the WBR footwall - WBR duplex- EBR hanging wall sequence (see geologic map), but has also exposed Acadian isotherms and isobars that were uplifted by Alleghanian thrusting if our hypothesis is correct.



Mapped Acadian isograds from the MB study area indicate inversion because of increasing grade to the southeast combined with a regional southeast dip. Our analysis indicates that the southeast structural dip of isograd surfaces, at least in the MB study area, is due solely to the effects of the Alleghanian cross-fold. Reconstruction of the pre-Alleghanian kyanite isograd indicates that the original inclination was to the northwest, therefore, the apparent isograd inversion is due to Alleghanian cross-folding.

SUMMARY

The MB and NAP study areas are examples of regions where Alleghanian deformation has produced enough exposed structural relief to allow geothermal and geobarometric estimates to detect the effects of Alleghanian structures such as footwall ramps or cross-folding.
In essence, early Acadian isothermal and isobaric surfaces served as passive markers that are later folded by Alleghanian deformation. If sufficient structural relief is produced by the later deformation event, it can be detected and quantified with geothermobarometric techniques. Retro-deforming the effects of the regional cross-fold in the MB study area produces an isograd geometry that is not inverted. Recognition of a high T-P axis in the NAP study area may delineate a regional footwall duplex ramp structure.