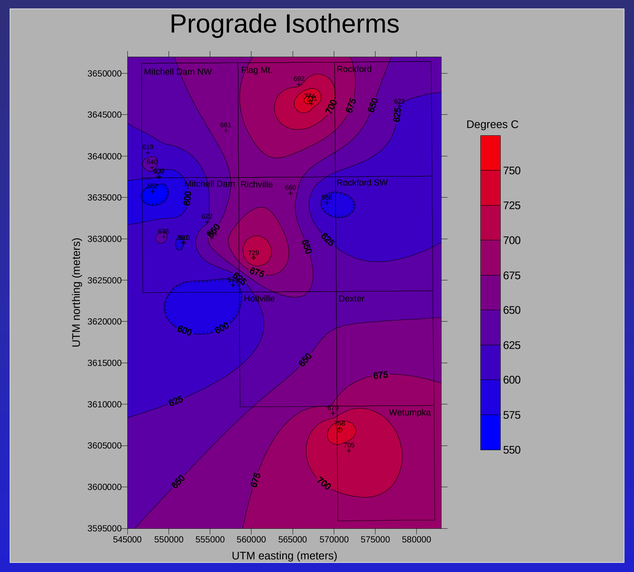
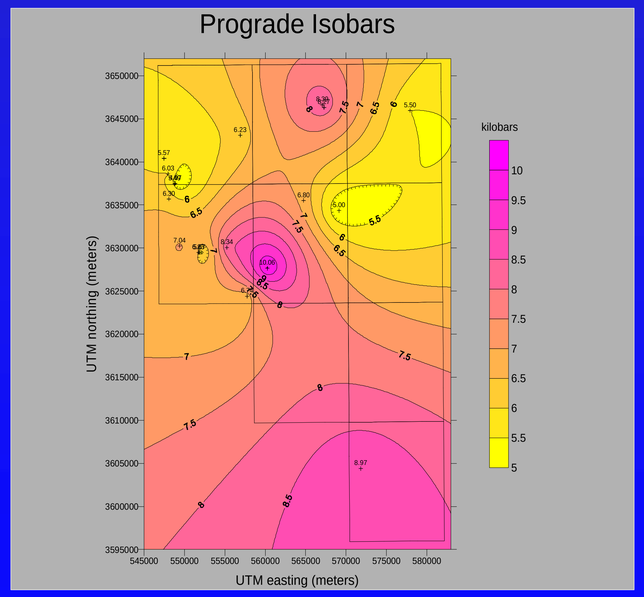
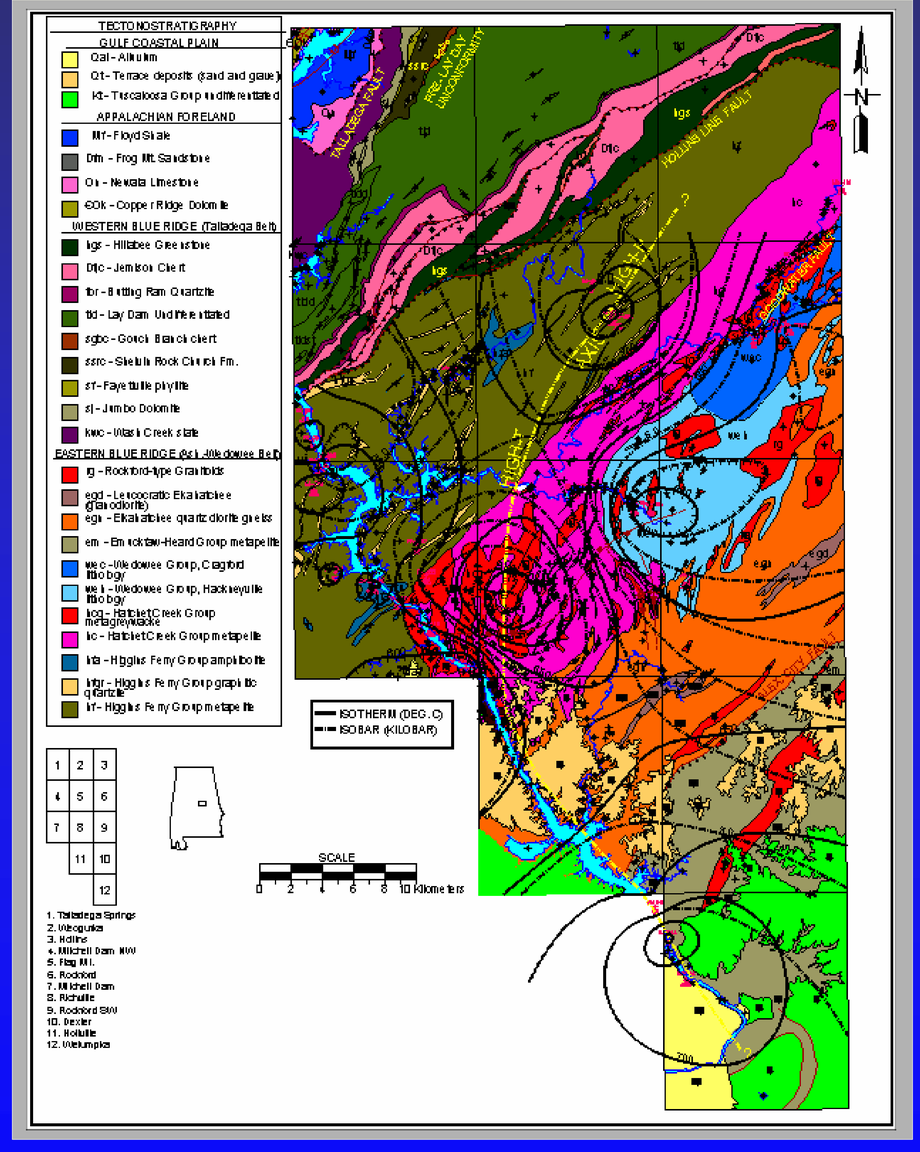
USING THERMOBAROMETRY TO DETECT FAULT RAMP FOLDING OF ACADIAN ISOTHERMAL AND ISOBARIC SURFACES: AN EXAMPLE FROM THE ALABAMA EASTERN BLUE RIDGE BELT



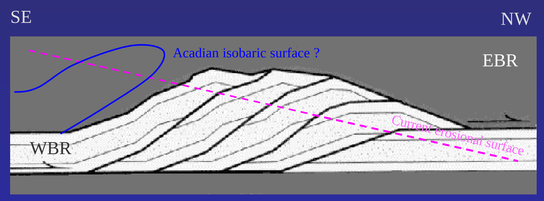
Contours of temperature estimates for Alabama EBR prograde samples. Note the temperature "highs" trending along a NE-SW-SE axis through the Flag Mt., Richville, Holtville, and Wetumpka quadrangles. Sample locations are indicated by the cross symbols.



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



The above geologic map of the Alabama EBR 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 along a footwall duplex ramp may explain the high T and P axis geometry, and that the ramp is oblique to the strike of the Hollins Line Fault. If this is true a significant dextral strike slip component must be present within the net slip of the Hollins Line roof thrust.



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 and possibly folded by Alleghanian thrusting.

SUMMARY

The study areas is one example of a region where Alleghanian deformation has produced enough exposed structural relief to allow geothermal and geobarometric estimates to detect the effects of Alleghanian structures- in this case a footwall ramp. In essence, early Acadian isothermal and isobaric surfaces served as passive markers that are later folded by subsequent Alleghanian deformation. If sufficient structural relief is produced by the later deformation event, it can be detected and quantified with geothermobarometric techniques. We believe that the trend of the high T-P axis in the Alabama EBR study area delineates a regional footwall duplex ramp structure at depth that is oblique to the strike of the exposed roof thrust. This requires a significant dextral strike slip component along the regionally important Hollins Line thrust system.

REFERENCES AND DATA SOURCES

Allison, D.T., 1992, Structural evolution and metamorphic petrogenesis of a metasediment and metaigneous complex, Coosa County, Alabama [Ph.D. dissertation]: Tallahassee, Florida, Florida State University, 378p.

Cook, T.A. 1983, Stratigraphy and structure of the central Talladega slate belt, Alabama Appalachians [M.S. thesis]: Tuscaloosa Alabama, The University of Alabama, 105p.

Drummond, M.S., 1986, Igneous, metamorphic, and structural history of the Alabama tin belt, Coosa County, Alabama [Ph.D. dissertation]: Tallahassee, Florida, Florida State University, 411p.

Drummond, M.S., Allison, David T., and Wesolowski, David J., 1994, Igneous petrogenesis and tectonic setting of the Elkahatchee Quartz Diorite, Alabama Appalachians: Implications for Penobscotian magmatism in the eastern Blue Ridge, American Journal of Science, Vol. 294, pp. 173-236.

Long, A.L., 1981, Relationship between the structure and geochemistry of the copper deposits of the Hillabee Greenstone in the Millerville region, Clay County, Alabama [M.S. thesis]: Tuscaloosa, Alabama, University of Alabama, 233p.

Tull, J.F. 1998, Analysis of a regional middle Paleozoic unconformity along the distal southeastern Laurentian margin, southernmost Appalachians: Implications for tectonic evolution: GSA Bulletin, v. 110, no. 9, p. 1149-1162.