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Cenozoic shortening in the Achara-Trialet zone of the Lesser Caucasus

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Between the Black and Caspian seas, the northern margin of the Tethyan realm and the Arabia-Eurasia collision zone is defined by the Greater Caucasus Mountains in the north and the Lesser Caucasus Mountains in the south. In Georgia, the Cenozoic Achara-Trialet fold-thrust belt defines both the northern margin of the Lesser Caucasus Mountains and the transition between the Caucasus region and the Turkish-Iranian Plateau to the south. Although the Achara-Trialet belt is a prominent structural system within the Arabia-Eurasia collision zone, the magnitude and timing of shortening accommodated across this belt are poorly known. The best regional cross-sections to date are reported by Banks et al., 1997 [1]. To test these sections and better determine the style, magnitude, and timing of shortening in the Achara-Trialet, we are integrating new 1:100k structural mapping, geochronology, and low-temperature thermochronology with prior geologic mapping (1:50k and 1:200k) along the Mtkvari River through the Achara-Trialet near Borjomi, Georgia and a second transect between Akhaltsikhe and Baghdati, Georgia. In this area, the cross-strike width of the Achara-Trialet is ∼50-70 km. Prior work indicates the belt deforms a section of Paleogene volcanic, volcaniclastic, and clastic rocks. We find that shortening in the Achara-Trialet appears to be as young as Miocene, with units as old as Cretaceous involved in the deformation based on our preliminary mapping and previously reported unit ages. The style of deformation is predominantly north-vergent folding, comprising ∼5 first-order anticlines, with a wavelength of ∼5-10 km. The orientation of fold axes appears to be consistent along strike, but further field measurements are necessary. There are two significant east-west striking and north-directed range-front thrust faults in the study area defining the northern margin of the belt. The eastern thrust locally places middle Eocene over Lower Miocene strata. The western thrust locally places Cretaceous over Sarmatian-Pontian strata. An additional north-directed thrust in the interior of the belt places Cretaceous over Eocene strata. The southern margin of the belt preserves a young basin, the Akhaltsikhe depression, in which Oligo-Miocene strata are folded. Contact relations between the Eocene strata to the north and the Oligo-Miocene deposits in the Akhaltsikhe depression are the subject of future work. Upper Miocene marine nanofossils have been reported from deposits in the Akhaltsikhe basin [2] that are now at an elevation of about 1000m. Assuming deposition of this unit was at sea level and an age of ∼5-10 Ma yields an estimated surface uplift rate of about 0.1-0.2 mm/yr for this region. Future work will seek to use low temperature thermochronology and radiometric dating of the deformed units to better constrain the surface uplift and exhumation in the Akhaltsikhe region and across the Achara-Trialet belt. We will conduct additional mapping where published maps are inconsistent, collecting more samples for thermochronology and geochronology to fill out the deformation history, and conducting additional range-perpendicular mapping transects to create cross-sections further west in the Achara-Trialet.

[1] Banks et al., 1997, AAPG Memoir 68
[2] Adamia et al., 2017, GSA Special Paper 525