Geophysical Research Abstracts
Vol. 20, EGU2018-19749-1, 2018
EGU General Assembly 2018

Structure of eastern segment of Adjara-Trialeti fold-thrust belt: insights from structural data and balanced cross sections (Northern Lesser Caucasus)

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Between the Black and Caspian Sea, the Caucasus region absorbs the majority of present-day convergence between the Arabian and Eurasian plates. This region is located along the northern margin of collision zone, ~700 km north of the plate suture. Determining the location, geometry, and rates of deformation on active structures within this belt is essential for characterizing earthquake hazard in the Caucasus and for understanding why strain has localized here. Within the Caucasus region, the 300-km long Adjara-Trialeti fold-thrust (ATFT) belt defines the northern edge of the Lesser Caucasus Mountains and the East Anatolia Plateau to the south, where it stretches from Black sea in the west to the Georgian-Azeri border in the east, passing through Tbilisi, the capital of Georgia (population ~1.4 M). The ATFT is separated from the Greater Caucasus Mountains to the north by the Rioni and Kartli foreland basins, which are slightly deformed, although locally the 2 ranges appear to be colliding along the southern margin of the Dzirula massif and in the vicinity of Tbilisi. Structural, geodetic and seismic data show the ATFT is active, and absorbs 3-7 mm/ yr. of northward motion of the East Anatolia Plateau relative to stable Eurasia. At the eastern end, the east-striking and north-vergent ATFT intersects with the south-vergent and northwest-striking Kura fold-thrust belt, which defines the southern flank of the Greater Caucasus. This intersection occurs in the vicinity of Tbilisi. As a result of the structural interference between the two thrust belts, the structure of the eastern segment of ATFT is complicated.

To understand the structure and characterize potential seismic sources in this complex region of structural interference, we are integrating prior structural mapping with new neotectonic investigations. Specifically, we are compiling a new 1: 25,000-scale geological map of the eastern part of ATFT and adjoining areas from Soviet-era geological mapping and our own structural measurements. Using this map in combination with borehole data and seismic profiles, we are constructing a balanced geologic cross-section across the range to evaluate the subsurface structure. These data were originally collected for oil and gas, as well as geothermal exploration. In addition, we are integrating these observations with earthquake data by comparing our inferred structures with clusters of elevated crustal seismicity seen in a new catalog of relocated events. Main goals of this work are to evaluate the potential for a large basal detachment fault beneath the eastern segment of ATFT, identify potentially active faults rooting into this detachment, and to calculated the shortening rates along these structures.