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Neotectonic and cross-sectional evidence of along strike variation of strain in the Greater Caucasus mountains

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The east-northeast-trending Greater Caucasus Mountains lie between the Black and Caspian Seas to the west and east, respectively, forming the northern edge of both the East Anatolian Plateau and the Arabia-Eurasia collision zone. Recent geodetic investigations indicate the rate of northeast-southwest convergence across the range increases systematically from ∼2mm/yr in the west (∼42.5˚E Long.) to ∼14mm/yr in the east (∼49˚E Long.) (Reilinger et al., 2006). This along-strike variation has been interpreted to indicate that the East Anatolian Plateau and Lesser Caucasus behave as a rigid block that rotates counterclockwise about an Euler pole in the eastern Black Sea (Reilinger et al., 2006). Importantly, it remains uncertain if this along-strike variability in convergence rate is a short-lived (∼0.1 to 1 kyr) aspect of the deformation field or is representative of the long-term (0.1 to 1 Myr) kinematics of the Arabia-Eurasia collision. If this along-strike variation in shortening rate has been long-lived, then the forelands at the eastern end of the range should show greater amounts of total shortening than the forelands in the west. However, no comprehensive comparison has yet been made between the neotectonics of the western and eastern segments of the range. To address this problem, we used the Real-time Interactive Mapping System (RIMS) (Bernardin et al., 2006) to construct neotectonic maps of the northern and southern flanks of the Greater Caucasus foreland. RIMS is a new, freely available, interactive, virtual-reality mapping application that facilitates neotectonic mapping. In RIMS, geo-referenced imagery is draped over a digital elevation model allowing features to be observed and mapped directly on the terrain display in real-time. In addition to geo-referenced and attributed line mapping, bedding attitudes can also be measured. Using RIMS with Aster VNIR L1B imagery (15m pixel resolution) draped over Aster DEMs (30m pixel resolution) we investigated the Terek and Sunzha An-

ticlines (43.5˚N, 44.5˚E) on the north side of the Greater Caucasus near Grozny, and both the Kura-Alazani basin fold-thrust belt (41˚N, 46.5˚E) and the Rioni basin (42˚N, 42˚E) at the eastern and western ends, respectively of the southern edge of the Greater Caucasus. Our neotectonic mapping of these foreland areas suggests that recent shortening is concentrated in the Kura-Alazani fold-thrust belt and that this belt shows pronounced west-to east structural asymmetry opposite to that expected from the GPS data. In particular, we find that at the western end of the Kura-Alazani fold-thrust belt, near T'Blisi, both the north-south width and the area (i.e., cross-sectional area of topography elevated above the surrounding basin) of the fold-thrust belt are $\sim$ 3 times greater than to the east, near Baku. The western end of the belt is also characterized by a significantly higher density of Miocene to recent shortening structures. These results are unexpected because the eastward-increasing GPS velocities predict corresponding eastward increases in total shortening, rather than the westward-increases suggested by the neotectonic geology. The eastward-decreasing total shortening and eastward-increasing GPS rates can be reconciled if convergence is slower in the west than the east but initiated earlier at the western end of the fold-thrust belt and then propagated eastward over time. Alternative explanations for the systematic west-to-east variations in width, area, and structural complexity within the Kura-Alazani fold-thrust belt include 1) along-strike changes in the structural style from thin-skinned thrusting in the west to thick-skinned deformation in the east or 2) simultaneous initiation of deformation along the belt with eastward-decreasing rates of shortening, which conflicts with the GPS data. To discriminate between these possible solutions, we are integrating previously published data on the stratigraphy and structure of the Kura-Alazani basin with our neotectonic mapping in an attempt to produce a series of balanced cross sections across the Greater Caucasus.