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Uplift of the southern Central Anatolian Plateau from 87Sr/86Sr stratigraphy on margin-capping marine sediments

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The Central Anatolian Plateau is at the crux of one of the most complicated tectonic regions on Earth, bounded by the Aegean extensional province to the west, enigmatic subduction to the south, the Bitlis-Zagros collisional zone to the east, and the continental-scale North Anatolian Fault Zone (NAFZ) to the north. Possible mechanisms for generating the 1.5-km average elevations include lithospheric delamination, crustal scale thickening, climate-driven surface processes, or any combination of these. Critical for understanding the mechanism of surface uplift and how it fits within the regional tectonic setting is deriving better constraints on the temporal framework and pattern of surface uplift. The southern margin of the plateau, which is extensively overlain by Miocene marine sediments, offers some of the best potential to identify both the timing and magnitude of surface uplift.

We present $^{87}Sr/^{86}Sr$ data on some of the highest and youngest marine sediments that presently cap the southern plateau margin. Analyzed samples, including oysters and foraminifera, cover a region of >150 km along the southern margin, from the Antalya Basin to the Ermenek Basin. Measured ratios average 0.708888 in the west (1450 m elevation), 0.708832 at the middle site (1885 m elevation, ~200 m below the highest marine sediments), and 0.708813 at our eastern-most site (1845 m elevation). Comparing these values to the global sea water $^{87}Sr/^{86}Sr$ curve (LOWESS IV) suggests ages of ~10 Ma in the west, ~12.5 Ma at the middle site, and ~13 Ma in the east. However, a potential complication concerns the late Miocene Mediterranean sea water $^{87}Sr/^{86}Sr$ curve, which shows a major departure from the global $^{87}Sr/^{86}Sr$ curve when the Mediterranean became isolated from global ocean circulation (e.g., McCulloch and De Deckker, 1989). Whether or not our samples are young enough to have been affected by this event (and thus ratios should be interpreted as late Tortonian to early Messinian in age) will be tested by comparing $^{87}Sr/^{86}Sr$ data to micro- and nannofossil stratigraphic analyses of the same sections.

If our measurements can be interpreted using the global ocean $^{87}Sr/^{86}Sr$ curve, the trend of younger capping marine sediments from east to west suggests that initiation of uplift also followed an east to west trend. Such a pattern correlates with the history of development of the NAFZ, which is interpreted to have an eastward-younging trend, based on a late Miocene initiation of fault-related sedimentary basins in the east (e.g., Refahiye and Erzinkan Basins), and successively younger basins to the west. Surface uplift along the southern margin may therefore be closely associated with development of the NAFZ and the onset of regional "escape tectonics". One potential mechanism for southern margin uplift could be internal deformation of the Anatolian plate, leading to counter-clockwise rotation and subsequent compression along the southern margin. Such internal rotation is suggested by GPS velocity data from Central Anatolia, which show a counter-clockwise rotation of vectors when plotted in an Arabia-fixed reference frame. Alternatively, changes in subduction along the Cyprus arc (e.g., the geometry and integrity of the subducting slab) may have led to local surface uplift along the southern margin.