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Oxygen and carbon isotope signatures of Neogene to recent surface elevation and climate change of the Central Anatolian Plateau

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We present oxygen and carbon isotope data from Neogene fluvio-lacustrine and pedogenic carbonates that were analyzed to place constraints on the paleoenvironmental conditions during the evolution of the Neogene Central Anatolian Plateau (CAP). Our long-term objective is to assess the role of climatic and orographic factors that have governed the distribution (and isotopic composition) of precipitation across the CAP from the Neogene to recent. Such data is fundamental in understanding CAP evolution in general and the role of the uplift of the Pontide and Tauride mountain ranges in particular – an event that we postulate to have given rise to changing atmospheric circulation as well as rainout patterns during CAP surface uplift.

In this study, sample batches were used that have been collected along with bio- and magnetostratigraphic sampling campaign. Whole-rock samples were digested in phosphoric acid and analyzed as CO_2 by a Thermo Delta V mass spectrometer operated in continuous flow mode and interfaced to a Thermo GasBench II.

We identify relatively dense spatial clustering of the carbonate δ^{18}O and δ^{13}C values which to some extent appears to reflect temporal variations as well:

- Lacustrine beds in the Ermenek Basin at the S plateau margin and in the Çankırı Basin (Kullar, Kaleçik) and Kastamonu Basin (İnceboğaz) at the plateau interior, all of them being up to Middle Miocene in age, range in δ^{18}O from 23.5 to 28.5 ‰ vs. SMOW. The Ermenek Basin carbonates display very uniform δ^{13}C values of -1.0 $\pm$ 0.5 ‰ vs. PDB, which contrast the other deposits having a broader range of more negative δ^{13}C values (-8 to -5 ‰).
- Lacustrine beds of Late Miocene to Early Pliocene age in the Ankara region (Gökler, Bucuk) span a range in δ^{18}O values comparable to the older lakes, albeit forming a distinct cluster at notably more positive δ^{13}C values of 1 to 7 ‰.
- Latest Miocene to recent pedogenic carbonates were analyzed from several localities: both at the outer flanks of the mountain ranges bordering the CAP and in the plateau interior. They show regionally distinct values with a very restricted variation for each region in both δ^{18}O and δ^{13}C. They range in δ^{18}O from 24.5 to 26.0 at the outer margin of the S range (Adana region) and from 20.0 to 23.5 ‰ in the plateau interior which likely translate to a $\Delta(\delta^{18}\mathrm{O})_{margin-plateau}$ of ca. +3 to +6 ‰ . Fossil and recent pedogenic carbonates show no significant difference in their isotopic composition at any locality. Pedogenic carbonates from the N outer margin of the CAP cannot be distinguished isotopically from those on the CAP itself.

From the above data we tentatively conclude that the evolving S margin of the CAP facilitated an effective orographically controlled change in the isotopic composition of N-directed, moist air masses entering the CAP. An onset of major surface uplift of the S margin not before latest Miocene appears probable. Further improvement of the timing and duration of carbonate formation, however, is of prime importance for a detailed description of the related causes and effects of regional climate change and contemporaneous surface uplift.