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Scientific Comment on McPhee et al "Preparing the ground for plateau growth: Late Neogene Central Anatolian uplift in the context of orogenic and geodynamic evolution since the Cretaceous", Tectonophysics 822 (2022), 229131

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McPhee et al. (2022) and a number of other recent papers (e.g., Göğüş et al., 2017; Meijers et al., 2020; Brocard et al., 2021), have discussed the cause of uplift of the Anatolian Plateau, which has an average elevation ~ 1 km. The assumption in these papers is that the uplift of the Anatolian Plateau occurred in the last 10 million years, as summarized in the abstract of McPhee et al. (2022) "The 1-km-high plateau interior uplifted since c. 8–5 Ma…". However, the available data, discussed below, show that the Anatolian Plateau has been a land area since 41 Ma (late Middle Eocene), and there is no reliable data that the uplift occurred in the last 10 million years.

A robust datum for the start of uplift is provided by the youngest marine sedimentary rocks in a region. The recent fast uplift of the Taurides, which constitutes the mountain range south of the Anatolian Plateau, is deduced from the preservation Upper Miocene and younger (<8 Ma) marine sedimentary rocks at high elevations (Fig. 1, e.g., Cosentino et al., 2012; Schildgen et al., 2012; Öğretmen et al., 2018). On the other hand, the age of the youngest marine sedimentary rocks on the Anatolian Plateau, in the Pontides and in the western Anatolia are Middle Eocene (ca. 41 Ma, Fig. 1, Okay et al., 2020). This shows that the Anatolian Plateau has been continuously above sea level in the last 41 million years. Considering sea level fluctuations (e.g., Miller et al., 2020), Central Anatolia must have been at least 80 m above the present sea level since 41 Ma. Neogene basins, with sedimentary thicknesses reaching several kilometers, crop out over large areas in central and western Anatolia (Fig. 1). The basins are filled by lacustrine and fluviatile sediments with no marine intercalations, and are mostly of Early Miocene to Pliocene ages (Okay et al., 2020), which implies semi-continuous uplift during the last 22 million years. Uplift and erosion during the Late Eocene and Oligocene in the Western and Central Anatolia are indicated by two sets of observations: a) Neogene continental sedimentary rocks lie unconformably over a great variety of sedimentary, magmatic and metamorphic rocks ranging in age from Paleozoic to Middle Eocene (Konak et al., 2016) indicating uplift and erosion before the deposition of continental Neogene sedimentary rocks, and b) Compared to Miocene and younger sequences, there is little record for the Upper Eocene and Oligocene continental sedimentation in the Central Anatolia implying a period of uplift and erosion.

Arguments for the post-10 Ma uplift of central Anatolia are few. McPhee et al. (2022) state that "Channel incision and long-wavelength knick zones in northern Central Anatolia (Doğan, 2011; Çiner et al., 2015; McNab et al., 2018) and stable isotopes from continental basin rocks (e.g., Meijers et al., 2018) point to uplift since the late Miocene". McNab et al., 2018 have analyzed river profiles in Anatolia to deduce the uplift rate, however this is based on assumption that "A patchy distribution of marine sedimentary rocks indicates that large portions of Eastern and Central Anatolia were below mean sea level until middle and late Miocene times, respectively" (McNab et al., 2018), which is demonstrably not the case. The three river incision studies (Doğan, 2011; Aydar et al., 2013; Çiner et al., 2015) cited by McPhee et al. (2022) come from a small area in Central Anatolia (Fig. 1); the area is

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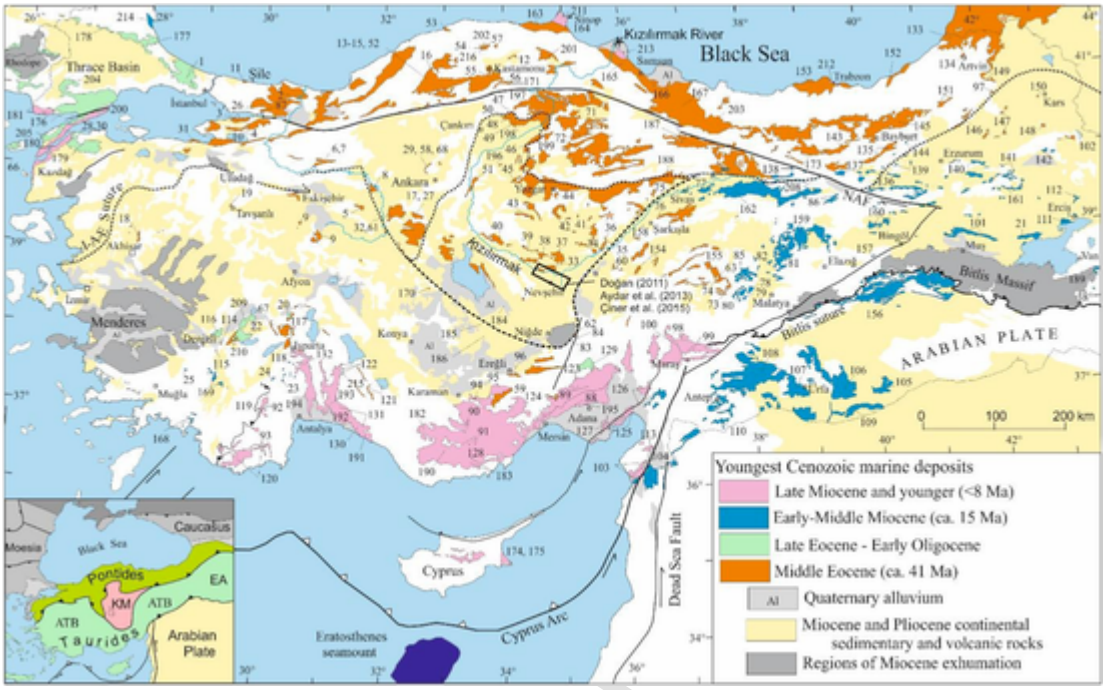

Fig. 1. Outcrops of the youngest Cenozoic marine deposits (modified from Okay et al., 2020). The numbers on the map are linked to Table S1 at (https://data.mendeley.com/datasets/27jpg8z52d/1), which provide lithology and age data for the numbered localities. ATB-Anatolide-Tauride Block, KM-Kirsehir Massif, EA-Eastern Anatolia, I-A-E Suture-Izmir-Ankara-Erzincan Suture, NAF-North Anatolian Fault.

close to several Quaternary and active faults (Emre et al., 2013) and is not representative for the whole of the Anatolian Plateau. Furthermore, in the river incision studies of Doğan (2011) and Aydar et al. (2013), the river in question is the Kızılırmak, which flows into the Black Sea (Fig. 1). In the last 25 million years the Black Sea had only intermittent connection with the oceans and has been a lake for considerably span of time (e.g., Palcu and Krijgsman, 2021). The fluctuations in the level of the Black Sea as well as changes in the elevation of the Anatolian Plateau, will control its incision rate. It is not possible to deduce an uplift rate of the Anatolian Plateau from the incision rate alone without knowing the water level of the Black Sea during the Cenozoic. Meijers et al. (2018) deal mainly with the post-8 Ma uplift of the Taurides, the stable isotope data from Meijers et al. (2018), summarized in Fig. 2 of McPhee et al. (2022) are highly scattered with values for post-8 Ma uplift ranging between -0.3 km to 1.5 km, which is compatible with a Basin and Range type topography during the Miocene.

In conclusion, Western and Central Anatolia have been a land area with fluctuating altitude and relief since 41 Ma (Middle Eocene). Unlike the Taurides, there is no data that the Western and Central Anatolia were uplifted in the last 10 Ma. It is implausible that the Central Anatolia was close to sea level for 31 million years, and then underwent 1 km of uplift. Until a precise and accurate uplift history of the Anatolian Plateau is determined for the last 41 My, models explaining "the post-10 Ma uplift" of the Anatolian Plateau has no meaning or relevance.

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Declaration of Competing Interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests.

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