Reply to 'Geochemical characteristics of Anatolian basalts: Comment on "Neogene uplift and magmatism of Anatolia: Insights from drainage analysis and basaltic geochemistry" by McNab et al.'

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Key Points:

- Revised compilation of Anatolian mafic igneous rocks does not affect our results
- Geochemical modeling is not contingent upon exact silica content
- Detailed geographic sub-division does not alter our conclusions

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Abstract

Uslular and Gençalioğlu-Kuşcu [2018] have written a lengthy, and highly critical, comment about *McNab et al.* [2018] which states that our data compilation for Neogene (and Quaternary) volcanic rocks from Anatolia is selective, inconsistent, and not fit for purpose. We state for the record that our compilation is not based on analyses from the published GEOROC database. *Uslular and Gençalioğlu-Kuşcu* [2018] also state that our sub-division of this database into three broad longitudinal categories is unrealistic since it does not consider the full range of different tectonic units. They conclude that our interpretation of the link between Neogene-Quaternary volcanism and uplift of Anatolia is erroneous. We refute this rather strongly worded comment by carefully addressing the five substantive issues raised.

We tackle the five substantive issues raised by *Uslular and Gençalioğlu-Kuşcu* [2018] as follows. First, we have revised the data compilation shown in our original Figure 11 by including analyses from the publications referred to by *Uslular and Gençalioğlu-Kuşcu* [2018] and 190 additional analyses to which they do not refer. We have also included a suite of publications that post-date the original submission of *McNab et al.* [2018]. Note that we deliberately excluded the analyses of *Parlak et al.* [2001] since these authors state that the relevant samples are crustally contaminated. Our revised data compilation is substantially the same as that shown in our original Figure 11 (Figure 1). However, it does differ in important ways from that presented by *Uslular and Gençalioğlu-Kuşcu* [2018]. Notably, we necessarily continue to screen analyses in order to exclude those with MgO < 5 wt%, which cannot easily be modeled. It also transpires that the compilation of *Uslular and Gençalioğlu-Kuşcu* [2018] contains several numerical transcription errors. The similarity between our revised and original compilations is unsurprising since the transition of subduction-influenced to ocean island basalt (OIB) magmatism within western Anatolia is well known. A small number of newly included analyses from the Konya province of Central Anatolia have significantly elevated ratios of K/Nb and Ba/Nb. These lamprophyres probably represent small melt fractions from an enriched source [*Asan and Ertürk*, 2013]. Note that their low Pb/Ce ratios as well as a lack of isotopic measurements mean that it is difficult to determine whether they are the products of arc volcanism or lithospheric contamination. Our revised data compilation and the associated reference list are available on request.

Secondly, *Uslular and Gençalioğlu-Kuşcu* [2018] repeatedly state that we have made a critical mistake by including samples that lie outside the typical silica range for basalts (i.e. 45–52 wt%) and by neglecting samples with < 5 wt% MgO that lie within this range. This inference is incorrect since SiO_2 content of mafic igneous rock is not strongly dependent upon fractionation of the olivine phase and can vary greatly with both source composition and equilibration depth. MgO content, however, is a more reliable proxy for fractionation of the early crystallizing phases. Thus MgO content is known to be the most appropriate and widely used tool for sample screening. Thirdly, we acknowledge that we have used the chronologic term 'Neogene' rather loosely and that we mislocated the Erciyes and Hasandağ stratovolcanoes. These minor errors do not affect the results and conclusions of *McNab et al.* [2018]. Fourthly, we did consider and test a more detailed geographic sub-division of Anatolian magmatism, along the lines of that proposed by *Uslular and Gençalioğlu-Kuşcu* [2018], during preparation of *McNab et al.* [2018]. This detailed subdivision does not affect the results and conclusions presented by McNab et al. (2018), notably an increase in asthenospheric temperature from west to east that accords with regional topography and with fluvial landscape analysis. Fifthly, we reject the assertion that generalization of an OIB-like affinity within the last 10 Ma is misleading. When appropriate sample screening is applied, compositions of mafic rocks from this time interval are close to those of OIBs with the exception of some more enriched samples, the origin of which we carefully discuss in *McNab et al.* [2018].

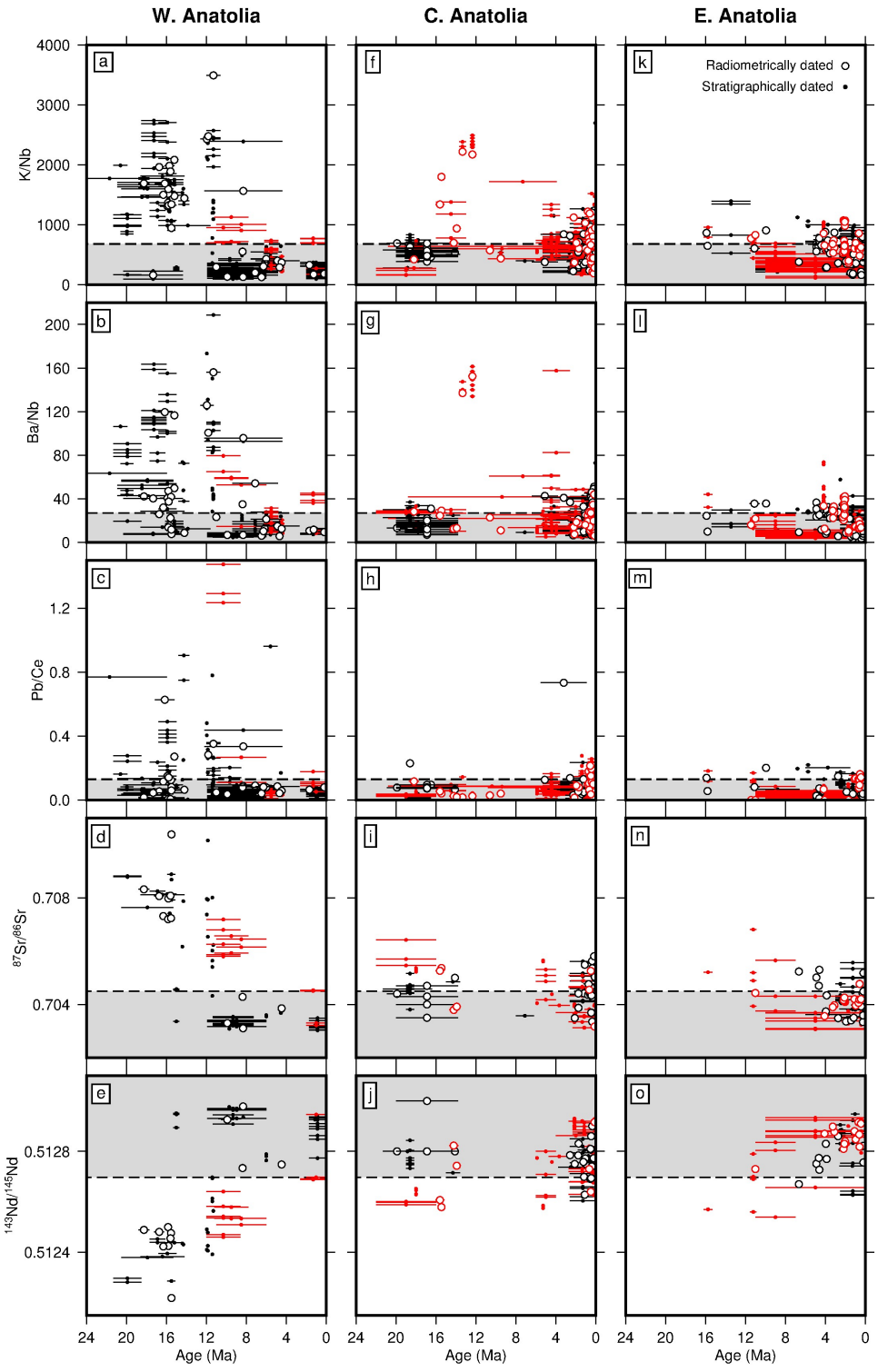

Figure 1. Revised version of our original Figure 11 [*McNab et al.*, 2018]. Geochemical analyses of mafic volcanism from Western, Central and Eastern Anatolia as function of radiometric age. Open circles with horizontal bars = radiometrically dated samples $\pm 1\sigma$; closed circles with horizontal bars = chronostratigraphically dated samples $\pm 1\sigma$; black = samples from original compilation of *McNab et al.* [2018]; red = additional samples; gray boxes with dashed lines = mean and standard deviation of ocean island basalts from GEOROC database (`http://www.georoc.edu`).

References

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