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COMMENT
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This article is a comment on McNab et al. (2018) https://doi.org/10.1002/2017GC007251.

Key Points:
- The geochemical interpretations of McNAB18 are open to discussion since the evolved samples in the data set are not excluded
- Discussion on the link between basaltic volcanism and uplifting in Anatolia is only based on a compiled geochemical data set
- The available geochronological data and different geodynamic settings in Anatolia should also be considered

Supporting Information:
- Supporting Information S1
- Data Set S1

Correspondence to:
G. Uslular,
goksuuslular@mu.edu.tr

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Geochemical Characteristics of Anatolian Basalts: Comment on "Neogene Uplift and Magmatism of Anatolia: Insights From Drainage Analysis and Basaltic Geochemistry" by McNab Et Al.

Göksu Uslular[1] and Gonca Gençalioğlu-Kuşcu[1]

[1]Department of Geological Engineering, Muğla Sıtkı Koçman University, Muğla, Turkey

Abstract Data compilation for Neogene basalts in Anatolia by McNab et al. (2018, https://doi.or/10.1002/2017GC007251 G-cubed) is selective and inconsistent, and it would not serve their purpose of showing how Neogene uplift and magmatism of Anatolia are related to processes within the asthenospheric mantle. The authors included not only a fraction of an extensive data set for Neogene basalts but also more evolved compositions other than basalts. Moreover, a compilation of basalt geochemistry data throughout the Anatolia based only on longitudinal division without considering different tectonic units and geodynamic processes is an unrealistic attempt. All these shortcomings result in erroneous interpretations especially for the understanding of the link between Neogene-Quaternary volcanism and uplift in the Anatolia.

1. Introduction

The recent paper with the title of *Neogene uplift and magmatism of Anatolia: Insights from drainage analysis and basaltic geochemistry* by McNab et al. (2018; hereafter McNAB18) discussed the "Neogene" uplifting and volcanism in Anatolia by using compiled data for basalt geochemistry and by extracting and modeling drainage profiles. The paper seems to serve a useful purpose for the understanding of uplift in the Anatolia using drainage systems. Despite the comprehensive approach on the drainage modeling for the Anatolia (except some typing mistakes in the river names), the same effort is not valid for the compilation of basalt geochemistry data. McNAB18 contains misleading interpretations regarding the volcanological and petrological evolution of Anatolia, due to insufficient and inconsistent data compilation. The authors reckoned that they compiled an extensive database of published basaltic samples to assess the relative importance of subduction and intraplate processes in generating Anatolian magmatism throughout Neogene times (p. 191). On the contrary, the data set of McNAB18 (Data Set S3 in the supporting information) does not comprise some key publications on the basalt geochemistry and geochronology, and 36% of the geochemistry data belong to the Quaternary volcanics (also note that sample As14 is Eocene in age; Aslan et al., 2014). McNAB18 claim "In order to mitigate sensitivity to the effects of fractionation and contamination, we only include samples with MgO>5 wt. %", but some of the data in their data set are evolved volcanics with SiO_2 > 52 wt. %. The authors refer to Schildgen et al. (2014) for the Neogene volcanic fields and sedimentary basins. However, the location of Hasandağ and Erciyes volcanoes (Figure 10) and distribution of Neogene volcanics in general on their maps (Figures 7i and 10 of McNAB18) are shifted (see Toprak, 1998, and Mineral Research and Exploration General Directorate of Turkey (MTA) 1/500,000 scale geological map for the exact locations). Based on the misplaced position of Erciyes, McNAB18 refer to volcanic phases "The first phase lasted from 20–14 Ma and principally occurred within the Galatia and Erciyes provinces, which are northwest and southeast of the Central Anatolian Plateau, respectively".

One of the main reasons of the debate is dividing Anatolia longitudinally into three regions as the western, the central, and the eastern Anatolia without considering the complex geodynamic and geologic processes in the evolution of Anatolia. This is an unrealistic attempt for Anatolia, which consists of several puzzle-like microcontinents (e.g., Şengör & Yılmaz, 1981). Considering all, we feel obliged to write this comment to declare the problems with data compilation and the misleading interpretations and to review the basaltic volcanism throughout the Anatolia based on the revised data set and related well-established literature.

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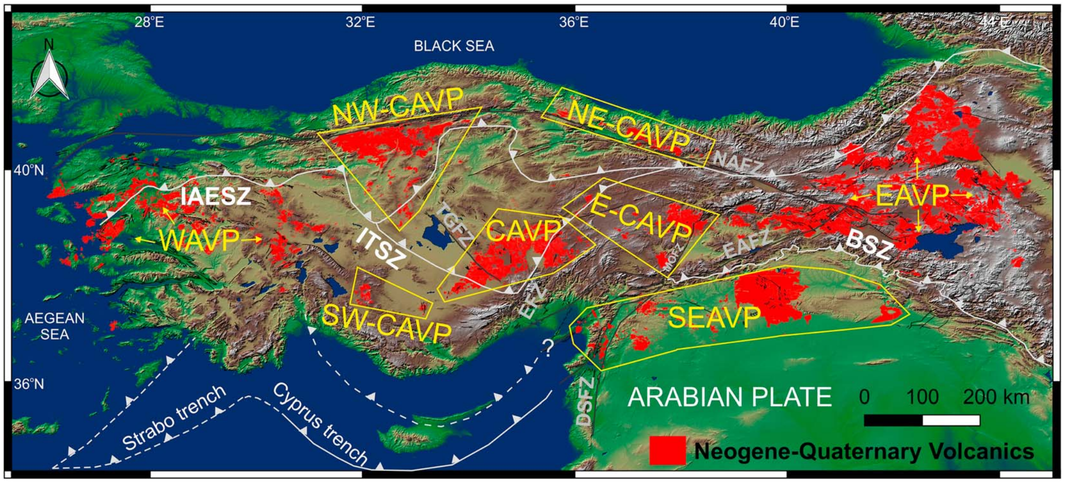

Figure 1. The distribution of Neogene-Quaternary volcanics in the Anatolia (compiled from MTA 1/500,000 scale geological map) on colored Shuttle Radar Tomography Mission (SRTM) image. The simplified main tectonic structures and sutures are from Okay and Tüysüz (1999). IAESZ = İzmir-Ankara-Erzincan Suture Zone; ITSZ = Inner Tauride Suture Zone; BSZ = Bitlis Suture Zone; NAFZ = North Anatolian Fault Zone; EAFZ = East Anatolian Fault Zone; TGFZ = Tuz Gölü Fault Zone; EFZ = Ecemiş Fault Zone; Dead Sea Fault Zone = DSFZ; MOFZ = Malatya-Ovacık Fault Zone.

2. Neogene-Quaternary Basaltic Volcanism in the Anatolia

The nature of Neogene-Quaternary volcanism (Alıcı-Şen et al., 2004; Çoban, 2007; Notsu et al., 1995; Reid et al., 2017) and uplifting (Aydar et al., 2013; Çiner et al., 2015; Göğüş & Pysklywec, 2008; Komut et al., 2012; Schildgen et al., 2014; Şengör et al., 2003; Westaway, 1994) throughout Anatolia has been invoked for several decades. The neotectonic evolution of Anatolia has been mainly represented by collisions of the Afro-Arabian plate with the Eurasian plate along the Hellenic arc to the west and the Bitlis Suture Zone (BSZ) to the east (Şengör & Yılmaz, 1981). This resulted in the widespread volcanism throughout Anatolia and along the major fault zones (Figure 1).

Contrary to division by McNAB18 mainly based on the spatial distribution of the volcanics, the volcanic fields including predominantly basaltic rocks should actually be grouped considering the geodynamic evolution of the Anatolia (Figure 1). This would probably be a more comprehensive and meaningful division of the widespread Anatolian volcanism for the sake of further petrological interpretations. Here we provide a short overview of the Neogene-Quaternary volcanism in the Anatolia prior to discussion of the problems in the data compilation and interpretations of McNAB18.

The Western Anatolian Volcanic Province "WAVP" is located at the eastern edge of the Aegean volcanic arc (Figure 1), and the N-S younging volcanism was initiated in the Late Oligocene to Early Miocene with high-K calc-alkaline affinity (also shoshonitic and ultrapotassic) followed by sodic alkaline basaltic volcanism in the Late Miocene to recent times (e.g., Aldanmaz et al., 2000, 2015; Alıcı et al., 2002; Agostini et al., 2007; Chakrabarti et al., 2012; Ersoy et al., 2012; Güleç, 1991; Platevoet et al., 2014; Prelevic et al., 2012; Yılmaz, 1989). The older basaltic rocks generally display typical subduction-related trace element geochemistry, whereas the younger ones (e.g., Kula) have strong anorogenic (Ocean Island Basalt "OIB"-like) characteristics possibly derived by asthenospheric mantle source (e.g., Aldanmaz et al., 2006, 2000, 2015) raised through the slab window within the subducting African lithosphere (Biryol et al., 2011).

The Central Anatolian (or Cappadocian) Volcanic Province "CAVP" is located at the Central Anatolian Crystalline Complex (Göncüoğlu et al., 1997) or Kırşehir Block (Okay & Tüysüz, 1999) which is bounded by the İzmir Ankara Erzincan suture zone to the north and the inner Tauride suture zone to the south and the east (Figure 1). The widespread volcanism in the CAVP initiated in the middle Miocene with some lava flows and widespread ignimbrite deposits and continued with the formation of several stratovolcanoes and numerous monogenetic volcanoes till the Holocene times (Aydar et al., 2012; Doğan-Külahçı et al., 2018; Pasquare et al., 1988; Platzman et al., 1998; Reid et al., 2017; Toprak, 1998). Two main lithospheric-scale strike-slip fault zones (namely dextral Tuz Gölü fault zone to the west and sinistral Ecemiş fault zone to the southeast) control the evolution of widespread postcollisional volcanism (refer to the collision between

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Arabian and Eurasian plates along the BSZ in the early Miocene; Okay et al., 2010) in the CAVP (Figure 1). However, there is still no consensus on the petrological evolution of the CAVP (e.g., Alıcı-Şen et al., 2004; Doğan-Külahçı et al., 2018; Gençalioğlu-Kuşcu, 2011; Gençalioğlu-Kuşcu & Geneli, 2010; Reid et al., 2017). Although most of the volcanics in the CAVP including the sodic-alkaline basalts (up to 6 wt. % nepheline normative) display trace element patterns typical for the subduction-related magmatism, this is possibly inherited geochemical affinity from the previous subduction history of the Anatolia (e.g., Gençalioğlu-Kuşcu & Geneli, 2010, and references therein). In addition, recent studies have shown that basaltic rocks with mildly sodic alkaline affinity are formed by the decompression melting of different components (enriched MORB-like peridotitic mantle modified by subducted sediments and influenced by deep-seated upwelling asthenosphere) under the effect of drip-like tectonism (e.g., Göğüş et al., 2017; Reid et al., 2017).

In the *NW-CAVP*, the volcanism initiated in the late Cretaceous (~76 Ma; Koçyiğit et al., 2003) and continued during the early Miocene (17–19 Ma) and the late Miocene (~10 Ma; Galatia volcanic province; Wilson et al., 1997). The alkaline basaltic rocks are mainly located along the North Anatolian fault zone (NAFZ) displaying OIB-like trace element signature and probably derived from the deep asthenospheric mantle source (Adiyaman et al., 2001; Varol et al., 2014; Wilson et al., 1997). Through the southern part of the NW-CAVP (Figure 1), there are also some other basaltic fields (Karacadağ, Asan & Kurt, 2011; Polatlı volcanics, Temel et al., 2010) with early to middle Miocene ages (~21–14 Ma). The alkaline basaltic rocks in the Polatlı region have almost similar source characteristics (OIB-like affinity) with some of the Galatia volcanics (cf. Temel et al., 2010), whereas the mildly alkaline basaltic rocks of the Karacadağ located at the western border of the Kırşehir block are considered to be derived from metasomatized lithospheric mantle with the contribution of upwelling asthenosphere (Asan & Kurt, 2011) similar to Quaternary CAVP basalts (e.g., Alıcı-Şen et al., 2004; Gençalioğlu-Kuşcu & Geneli, 2010; Reid et al., 2017). The volcanism has been observed along the NAFZ in the northeastern part of the CAVP (*NE-CAVP*; Figure 1), and the Plio-Quaternary (6.31–1.33 Ma; Ekici, 2016b) basaltic rocks are considered to be derived from asthenospheric source similar to Galatia volcanics (Adiyaman et al., 2001; Ekici, 2016b). In the *SW-CAVP*, on the other hand, the volcanism is represented by Erenlerdağ-Alacadağ and Sulutaş Volcanic Provinces (~22–3 Ma; Gençoğlu-Korkmaz et al., 2017; Keller et al., 1977; Temel et al., 1998). The mildly alkaline basalts in the region are possibly derived from asthenospheric source (i.e., OIB-like trace element pattern) and slightly enriched by recycled crustal rocks (Gençoğlu-Korkmaz et al., 2017).

In the *E-CAVP*, early Miocene (~24 Ma) to Pliocene (~4 Ma) basaltic volcanism generally formed along the fault zones (namely central Anatolian and Malatya-Ovacık fault zones; e.g., Arger et al., 2000; Kocaarslan & Ersoy, 2018; Kürkçüoğlu et al., 2015; Önal et al., 2008; Parlak et al., 2001). The basalts around the Sivas region (~24–4 Ma) display both anorogenic and orogenic (subduction-related) geochemical affinity (e.g., Kocaarslan & Ersoy, 2018; Kürkçüoğlu et al., 2015). The younger basalts have especially OIB-like geochemical characteristics in the multielement diagrams and are considered to be derived from an asthenospheric mantle source (Kürkçüoğlu et al., 2015). However, the older rocks with the orogenic geochemical signature have been recently attributed to assimilation and fractional crystallization processes acting on the asthenosphere-derived mantle (Kocaarslan & Ersoy, 2018). Through the eastern part of the region (Figure 1), there are other volcanic fields (namely Yamadağ and Kepez volcanic complexes) including early to late Miocene volcanics (~19–10 Ma; Ekici, 2016a; Ekici et al., 2007; Kürüm et al., 2008) with mainly orogenic geochemical affinity (Kürüm et al., 2008). In fact, the petrological evolution and the source characteristics have still been discussed in the literature, and the region has been generally considered with the NE-SW trending corridor of the East Anatolian Volcanic Province (EAVP; i.e., W-EAVP; Kürüm et al., 2008). Our division at that point is only based on the geographic location, and therefore, it is important to note that the geodynamic and petrological evolution of the eastern part of the region should not be directly linked with the volcanism around Sivas.

The volcanism in the Southeast Anatolian Volcanic Province "SEAVP" throughout the Arabian plate (Figure 1) has been active since early Miocene (~19 Ma) to Quaternary (~0.01 Ma) times (Alpaslan, 2007; Arger et al., 2000; Ekici et al., 2014; Italiano et al., 2017; Keskin, 2007; Keskin et al., 2012; Lustrino et al., 2010, 2012; Pearce et al., 1990; Parlak et al., 2000, 1999; Polat et al., 1997; Rojay et al., 2001; Varol & Alpaslan, 2012; Yurtmen et al., 2000, 2002) and can be geographically clustered with the EAVP. However, the formation of alkaline basaltic rocks (except Karacadağ volcanism) that has been derived by OIB-like asthenospheric mantle source is directly controlled by the main fault zones (e.g., Dead Sea

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Fault Zone) in the region (Alıcı et al., 2001; Alpaslan, 2007; Parlak et al., 1999; Polat et al., 1997). Karacadağ volcanism, on the other hand, has been active from late Miocene to Pleistocene (Ekici et al., 2012, 2014; Keskin, 2003, 2007; Lustrino et al., 2012, 2010). The volcanism in the region was especially dominated by the eruption of voluminous mafic lavas around ~11 Ma after the rapid domal uplift (Şengör et al., 2003). Heterogeneous mantle source with various degrees of melting is thought to be responsible for the widespread volcanism around the Karacadağ, and especially they are isotopically (e.g., enriched $^{87}Sr/^{86}Sr$ composition) contemporaneous with the other SEAVP volcanics (Ekici et al., 2012; Lustrino et al., 2010). Therefore, we divided this region as a separate group from the EAVP where there is a N-S trending postcollisional volcanism (along the BSZ; Figure 1) initiated at middle Miocene (~13 Ma) and continued to the historical times (e.g., Alıcı-Şen et al., 2004; Innocenti et al., 1976; Keskin, 2003, 2007; Keskin et al., 1998; Notsu et al., 1995; Oyan et al., 2016, 2017; Özdemir & Güleç, 2014; Pearce et al., 1990). There is a clear younging trend in the EAVP volcanism from the north (e.g., Kars-Erzurum plateau, ~11 Ma; Keskin et al., 1998) to the south (Etrüsk volcano, 4.7–3.6 Ma; Oyan et al., 2016; Süphan volcano, 0.76–0.06 Ma; Özdemir & Güleç, 2014). Even in some studies (e.g., Innocenti et al., 1976), the volcanism in the EAVP has been considered to initiate in lower Miocene with a calc-alkaline affinity and continued after ~6 Ma with more alkaline characteristics. In addition, the orogenic signature in the trace element geochemistry of the EAVP volcanics (also including basalts) diminished through the south with the contribution of an asthenospheric source (Ekici et al., 2012; Keskin, 2003, 2007; Oyan et al., 2016, 2017; Özdemir & Güleç, 2014). According to the geodynamic model of Keskin (2007), the widespread postcollisional volcanism in the EAVP is probably controlled by the delamination of lithospheric mantle in the north and slab steepening and break-off in the south.

In the light of the information mentioned above, the petrological and geodynamic evolution of the Anatolia with a special reference to the basaltic volcanism is not a simple task and cannot be revealed only by the longitudinal grouping of the volcanics. Our summary is also a simplification and probably not enough for the reader to understand the Anatolian volcanism in detail. Therefore, we strictly advise checking the well-established literature for further information.

3. Erroneous Data Compilation of Anatolian Basalts

Despite a good attempt to compile the geochemical data for the Anatolian basalts, McNAB18 had some critical mistakes in data compilation (Data Set S3) that affect the scientific interpretations at a fundamental level. McNAB18 claim that they compiled geochemical data for the Neogene basaltic rocks, while 36% of the samples in their data set are actually from Quaternary volcanics. In addition, they only considered the Anatolian basalts with a cutoff MgO value of >5 wt. % to eliminate the fractionation and contamination effects. They even took the samples with higher MgO (>8.5 wt. %) for the calculation of mantle potential temperature and inverse geochemical modeling. However, data compiled for Anatolian basalts (Data Set S3) include about 300 evolved samples (52–63 wt. % SiO_2) out of the basaltic composition range. Of those, some also have high MgO contents (177 samples with >5 wt. % MgO and 22 samples with >8.5 wt. % MgO; see highlights in Data Set 3). Therefore, filtering the data set using MgO contents without considering typical silica range for basalts (in a strict sense) might result in misleading interpretations for the scope of McNAB18. For instance, there is a misinterpretation of the WAVP volcanics in Figures 11 and 12 of McNAB18 due to use of evolved samples (including subvolcanics as well). This will be discussed in the following parts in more detail.

The scarcity of a complete data set (i.e., geochronological, major, trace, and isotope geochemistry data for each volcanic sample) is one of the main problems for Anatolian volcanics. This certainly limits our knowledge on the petrological evolution of Anatolian volcanism but at least gives some crucial information for the temporal evolution of the volcanism. In addition, there are recent studies that provide new insight into the evolution of Anatolian volcanism (e.g., Delph et al., 2017; Doğan-Külahçı et al., 2018; Göğüş et al., 2017; Kocaarslan & Ersoy, 2018; Reid et al., 2017), and further studies will certainly follow. McNAB18 compiled the so-called basalt geochemistry from the literature, but they missed the essential studies on the temporal evolution of the Anatolian volcanism (e.g., Besang et al., 1977; Innocenti et al., 1975, 1976; Pasquare et al., 1988; Platzman et al., 1998). Here we list some of the misleading interpretations stemming from erroneous data compilation in McNAB18.

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- Figures 7e–7h of McNAB18 display the relationship between uplifted marine sediments and magmatism in different parts of the Anatolia. In these figures, it seems that magmatism in these regions postdates the uplifting. However, volcanism in Sivas basin initiated in early Miocene (~24 Ma) and continued until the Pliocene (~4 Ma) time (e.g., Arger et al., 2000; Innocenti et al., 1975; Kocaarslan & Ersoy, 2018; Kürkçüoğlu et al., 2015; Önal et al., 2008; Parlak et al., 2001; Platzman et al., 1998). Therefore, the black bar that indicates the time span of magmatism, especially in Figure 7f of McNAB18, should be extended to early Miocene, that is, the time of uplifting of marine sediments has been initiated. McNAB18 also asserted that there are two distinct magmatic phases in central Anatolia, and Sivas volcanics correspond to the second phase lasting from 5 Ma to the present day. However, as mentioned above, the volcanism around Sivas region is much older than thought by McNAB18 and cannot be associated with the so-called second phase of the volcanism in the central Anatolia (i.e., CAVP). The reader can also refer to a recent paper by Kocaarslan and Ersoy (2018, and references therein) for further details on volcanism around Sivas region.
- Similarly, McNAB18 also classified the volcanics around Hasandağ as the second phase of the volcanism in the central Anatolia. However, the volcanism around the CAVP (C. Anatolian Plateau in Figures 7c and 7g of McNAB18) commenced at around 13 Ma (Keçikalesi volcanics, Hasandağ; Besang et al., 1977; Deniel et al., 1998) and continued till the recent times (Aydar et al., 2012; Reid et al., 2017; Schmitt et al., 2014). Therefore, Figure 7 of McNAB18 should also be revised for the age of the magmatism in the CAVP. In addition, the magmatism considered for the uplifting of Mut basin is not clear in Figure 7h. If the volcanism in the CAVP is also associated with this region, the figure should also be revised for the Mut basin.
- McNAB18 suggested that the volcanism around the Galatia (NW-CAVP) and Hatay-Hassa-Osmaniye (western part of the SEAVP) is coeval (20–14 Ma), and therefore, they considered these regions as the first phase of volcanism in the central Anatolia. At this juncture, it is important to note that McNAB18 mislabeled the volcanics around the western part of the SEAVP as "Erciyes" (about 200 km of displacement; see Figure 10 of McNAB18), but we now overlook this mistake as there are much more important points that need to be discussed. For instance, the volcanism in the Galatia volcanic province has been considered to initiate in late Cretaceous (~76 Ma; Koçyiğit et al., 2003, and references therein) as an early phase of Galatia arc evolution. In addition, there are also other volcanics around the central Anatolia with ages between 20 and 14 Ma, namely, Yamadağ and Kepez volcanic complexes in the E-CAVP (19–10 Ma; Ekici, 2016a; Ekici et al., 2007; Kürüm et al., 2008) and Erenlerdağ-Alacadağ and Sulutaş Volcanic Provinces in the SW-CAVP (22–16 Ma; Gençoğlu-Korkmaz et al., 2017; Temel et al., 1998). Therefore, if the volcanism in central Anatolia was divided into different phases, the volcanism in the eastern and southwestern parts of the CAVP should also have been taken into consideration. In any case, one should attempt to group the volcanism based on different geodynamic settings around the central Anatolia where the volcanism should be defined separately to avoid possible misleading interpretations. Therefore, we tried to give some basic information about the volcanism for each region and also modified Figures 11 and 12 of McNAB18 to show the more realistic petrological evolution of the Neogene-Quaternary volcanics in the Anatolia.
- The geochemical data compilation of McNAB18 is rather selective for a typical data compilation study. Contrary to the main scope of their study, they compiled more evolved volcanics other than basalts as well, especially from the western Anatolia. There are also more evolved volcanics in other regions, and we added some of them to both their database and geochemical diagrams to show the misleading interpretations. In addition, we included almost 470 new geochemical data (written in bold in the modified Data Set S3 of McNAB18; in our supporting information Data Set S1) compiled from different geochemical database and search websites.
- Last but not the least, McNAB18 claimed that most of the petrological interpretations (e.g., transition from orogenic to anorogenic in the eastern Anatolia; Keskin, 2003, 2007) are mainly based on the basalts that have low MgO contents (page 204 of McNAB18). However, their data set includes almost 300 evolved samples (52–63 wt. % SiO_2) that have been incorporated in the geochemical interpretations (Figures 11 and 12 of McNAB18). This is in contradiction with their main scope and completely affects their geochemical interpretations especially for the volcanism in the WAVP (Figures 2 and 3 in our manuscript). The more detailed geochemical misinterpretations will be tackled in the following part.

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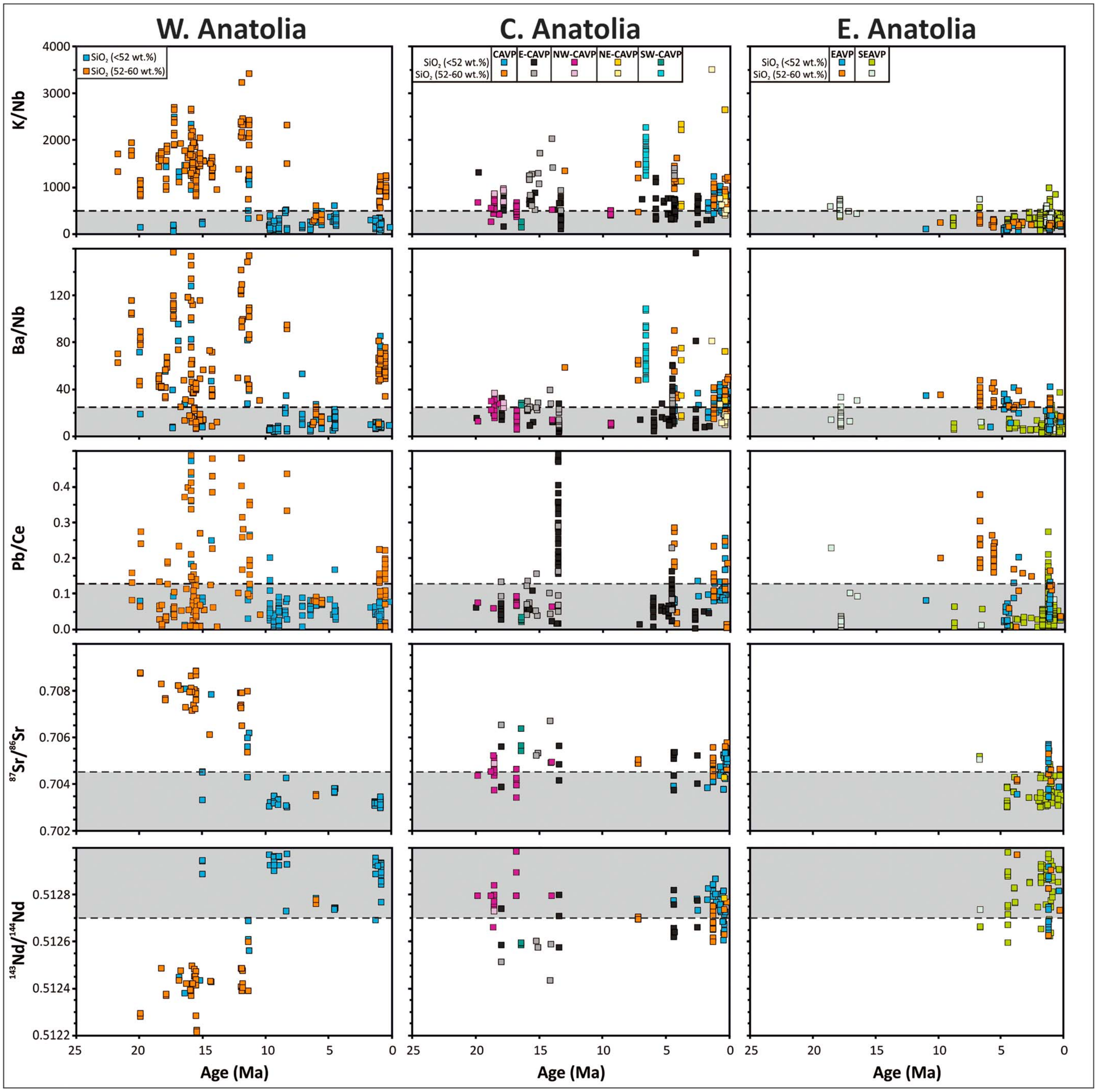

Figure 2. The modified version of Figure 11 in McNAB18. All geochemical data for each distinct volcanic region were grouped based on the SiO_2 content. The gray fields are from the original paper. Errors are not added for the sake of data presentation, but please check the modified data set S3 for further information. CAVP = Central Anatolian (or Cappadocian) Volcanic Province; EAVP = East Anatolian Volcanic Province; SEAVP = Southeast Anatolian Volcanic Province.

4. Geochemical Misinterpretations

Despite the general agreement on the evolution of postcollisional volcanism in the WAVP and EAVP, there is still no consensus for the CAVP, and our ongoing studies and other recent studies have been carried out to provide insight into petrological and geodynamical evolution of the CAVP (e.g., Abgarmi et al., 2017; Delph et al., 2017; Doğan-Külahçı et al., 2018; Reid et al., 2017). Slab retreat and related extensional tectonism resulted in the late Miocene to Holocene volcanism in the WAVP, and rising asthenosphere through the

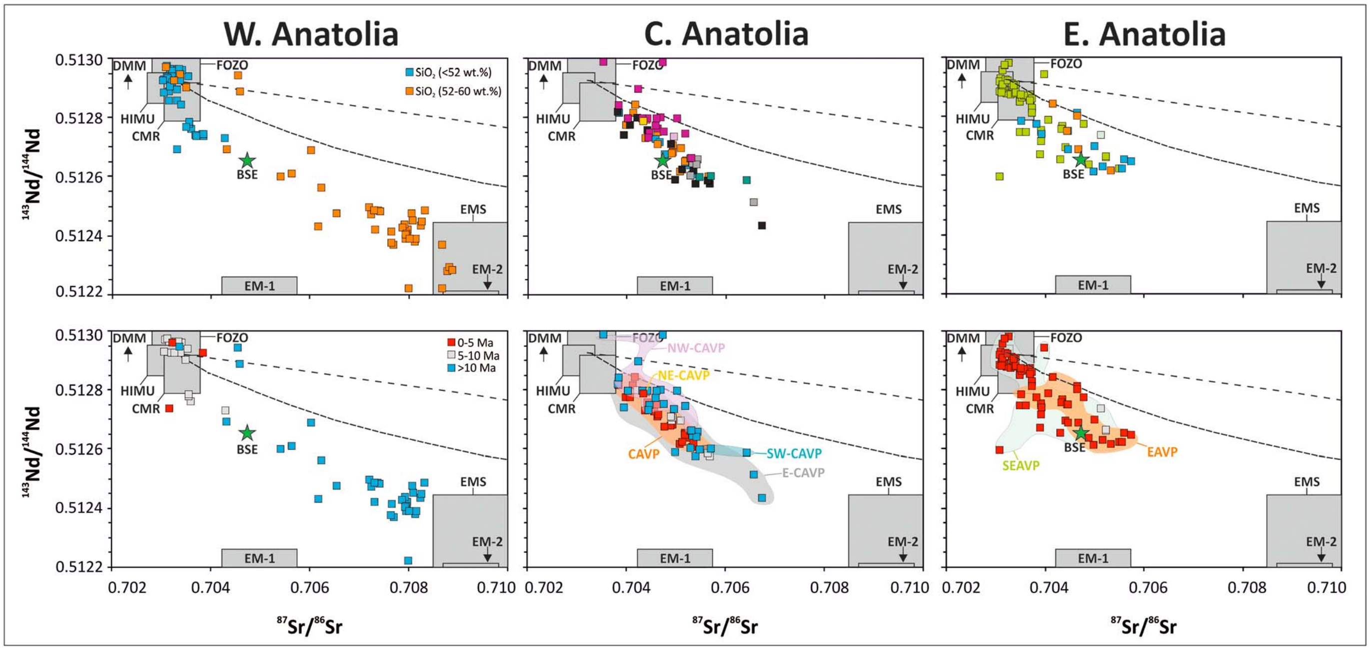

Figure 3. The modified version of Figure 12 in McNAB18. All the geochemical data for each distinct volcanic region were grouped based on the SiO_2 content (less than or greater than 52 wt. % SiO_2) and available ages (radiometric or inferred chronostratigraphy). All the gray fields and compositions (e.g., Bulk Silicate Earth, BSE) are from McNAB18 and references therein. The symbols are as in Figure 2.

slab tear is the most prominent source with the increasing OIB-like affinity for the volcanics formed during that time (Aldanmaz et al., 2015). McNAB18 also stated a similar scenario for the WAVP, but there are some misinterpretations due to the involvement of evolved samples (52–63 wt. % SiO_2) other than basalts (Figures 2 and 3 in our manuscript). For instance, Figure 2 (modified version of Figure 11 in the McNAB18) displays two distinct groups of geochemical data (i.e., basalts in a strict sense and higher silica rocks) in the WAVP, and it is obvious that most of the evolved samples are plotted above the OIB field (e.g., K/Nb > 500) interpreted as an indication of enrichment (McNAB18). We also added some evolved (>52 wt. % SiO_2) Quaternary samples from Isparta region (Çoban & Flower, 2007; Platevoet et al., 2014) to show that the enrichment trend is not only limited to the Neogene volcanics but also evident in the Quaternary volcanics (Figure 2). Besides, we compiled data on some evolved volcanics from the other regions to support our claim (supporting information Data Set S1). Once again, it is obvious that most of the evolved samples are enriched in terms of some trace element (K/Nb, Ba/Nb, and Pb/Ce) and isotope (Sr and Nd) ratios (Figure 2). It is clear that there is a tendency toward OIB-like anorogenic magmatism in the WAVP after late Miocene (e.g., Aldanmaz et al., 2006, 2015), and the Neogene rocks can be more enriched compared to the other volcanic provinces (e.g., CAVP) as claimed by McNAB18. However, when the evolved samples are excluded, the enrichment in WAVP and CAVP volcanics is almost identical (Figure 2). In fact, most of the Quaternary basalts from the CAVP display enrichment (or different composition, e.g., mixing of MORB-like enriched lithospheric and OIB-like asthenospheric sources; Reid et al., 2017) contrary to other Quaternary volcanics throughout the Anatolia (except for EAVP basalts) that generally plot within the OIB-like field (Figures 2 and 3).

In the isotopic compositions of Anatolian volcanics (Figure 3, modified version of Figure 12 of McNAB18), it is clear that the volcanics from different parts of the CAVP are isotopically enriched (except a few samples of NW-CAVP) similar to the WAVP (Neogene) and EAVP volcanics, whereas Kula and SEAVP volcanics generally plot in the depleted mantle part. This further reveals that the geodynamic processes in Anatolia are quite complex and directly affect the evolution of widespread volcanism. As the strike-slip fault zones (e.g., NAFZ, DSFZ, EAFZ, and Ecemiş fault zone) behave as a conduit for the volcanism, the volcanics located along these faults are mainly derived from deep asthenospheric sources (e.g., E-CAVP, NW-CAVP, NE-CAVP, and SEAVP). In addition, Kula basalts are derived from the upwelling asthenosphere through the slab window in the subducting African plate (Aldanmaz et al., 2015). On the other hand, the volcanics in CAVP and EAVP are considered to be formed by melting of heterogeneous mantle source including mainly MORB-like enriched lithospheric mantle with the contribution of OIB-like asthenospheric mantle (e.g., Gençalioğlu-Kuşcu & Geneli, 2010; Keskin, 2007; Oyan et al., 2016; Özdemir & Güleç, 2014; Reid et al., 2017).

Regarding the high MgO basalts, McNAB18 proposed that there is no clear transition from subduction-related (arc-like trace element signature) to intraplate volcanism (OIB like) in EAVP as opposed to the detailed studies in the region (e.g., Keskin, 2003, 2007). In the geographical division of McNAB18, Karacadağ basalts that we consider here with the other SEAVP volcanics are clustered with the other EAVP volcanics. Taking the strong OIB-like signature of the Quaternary Karacadağ basalts (Ekici et al., 2014; Lustrino et al., 2012) into account, there is a clear transition from orogenic to anorogenic magmatism through the northern part to the southern part of the region (Keskin, 2003, 2007; Keskin et al., 1998). However, McNAB18 refused such transition in the EAVP. If we only consider the volcanics in the EAVP excluding the Karacadağ volcanics according to our division, there is still a similar trend (not as clear as the former case though) in the geochemistry of the volcanics (even for MgO > 8.5 wt. %) that can be traced from calc-alkaline Erzurum-Kars plateau basalts to the north and OIB-like Nemrut and Tendürek alkali basalts to the south (Keskin, 2003, 2007). This is almost identical to the WAVP where the role of metasomatized mantle lithosphere (responsible for Early-Middle Miocene volcanics with strong arc-like composition) has been diminishing in time especially after Late Miocene (Aldanmaz et al., 2015). This possible transition is better observed in the multielement patterns of the volcanics from EAVP, but some of the trace element ratios (e.g., Ba/Nb; Figure 2) and isotope compositions (Figure 3) also support this claim.

The link between the basaltic volcanism and uplifting in Anatolia during Neogene-Quaternary is not well defined in the McNAB18. In most cases, uplifting in Anatolia (e.g., central Anatolia; Schildgen et al., 2014) is not a single episode and temporarily changed with a different rate in time. Similarly, there are some waxing stages in the volcanism throughout Anatolia (mainly Late Miocene and afterward). Although McNAB18 claimed that the volcanism postdates the initiation of the uplifting in most regions, we here showed that the volcanism in Sivas region, for instance, commenced in early Miocene and almost coeval with the uplifting of marine sediments in the region (Figure 7f of McNAB18). Therefore, it would be better to discuss the possible relationship between change in the uplift rate and the waxing stages of the volcanism.

Considering all, there are some critical misinterpretations of McNAB18 due to the erroneous data compilation (i.e., including not only basalts but also more evolved samples) and redundant attempt to divide the volcanism into phases or to discuss the transition (orogenic vs. anorogenic) in the volcanism. The geochemical data compilation without considering the available geochronological data and different geodynamic settings and based only on the longitudinal division of the volcanics resulted in the misleading interpretations not only for the evolution of the volcanism in Anatolia but also its link with the Neogene uplifting.

5. Concluding Remarks

The critical points in McNAB18 that we comment on are listed below:

1. The cutoff MgO value (> 5 wt. %) used to eliminate the evolved or fractionated Anatolian volcanics does not hold as there are evolved samples (out of basaltic composition range) even with higher MgO (>8.5 wt. %). We highlighted such mistakes in our revised version of McNAB18′s Data Set3 (supporting information Data Set S1). In addition, we included some missing basalt geochemistry data from different parts of the Anatolia. To point out the misleading geochemical interpretation of McNAB18, we deliberately added geochemical data of more evolved volcanics (e.g., WAVP, Platevoet et al., 2014; CAVP, Deniel et al., 1998; Kürkçüoğlu, 2010).
2. Locations of Erciyes and Hasandağ stratovolcanoes in CAVP (Figure 10) are erroneous, and color coding on this map does not reflect the age distribution of basaltic volcanism in Anatolia (especially for Sivas, CAVP, and EAVP). In addition, the distribution of Anatolian basalts on the maps (Figures 1b, 7i, and 10 of McNAB18) is shifted and includes both Neogene and Quaternary basalts.
3. Considering not only geochemical data and geographical distributions of volcanics but also geochronological data and different geodynamic settings in the Anatolia (cf. McNAB18), we suggested some additional subdivisions for volcanic regions mentioned above (e.g., NW-CAVP and E-CAVP). These subdivisions can still be considered as cluster for the simplicity of data presentation, but at least we

give some detailed information on the evolution of volcanism and also now it is relatively easy to follow the possible changes in the geochemical characteristics of the volcanics in different parts of the Anatolia (see our Figures 2 and 3).

4. The presence of asthenosphere beneath the central and eastern Anatolia has been suggested by geophysical models, but its role for the evolution of the CAVP and EAVP basalts has still been discussed. Therefore, the generalization of OIB-like affinity for all Anatolian basalts formed in the last 10 Ma by McNAB18 is a misleading interpretation. In addition, the link between uplifting and basaltic magmatism in Neogene-Quaternary time should be tackled in consideration of both geochemical changes and some waning/waxing stages in the volcanism during the evolution of Anatolian plateau.

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All data used throughout the manuscript are properly cited and referred in the reference list.

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