Multiple magmatic processes revealed by distinct clinopyroxene populations in the magma plumbing system: a case study from the Miocene volcano in West Qinling, Central China

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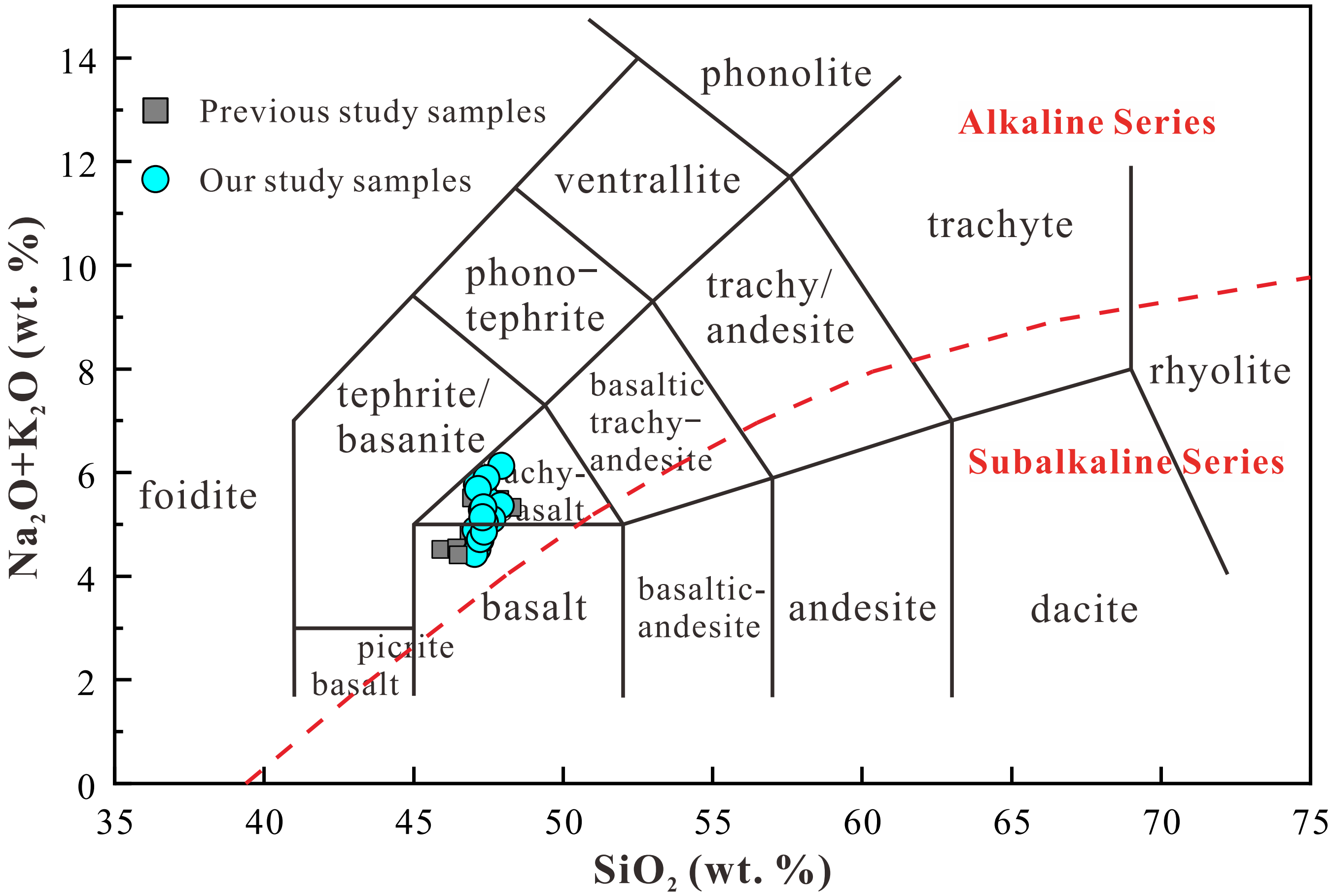
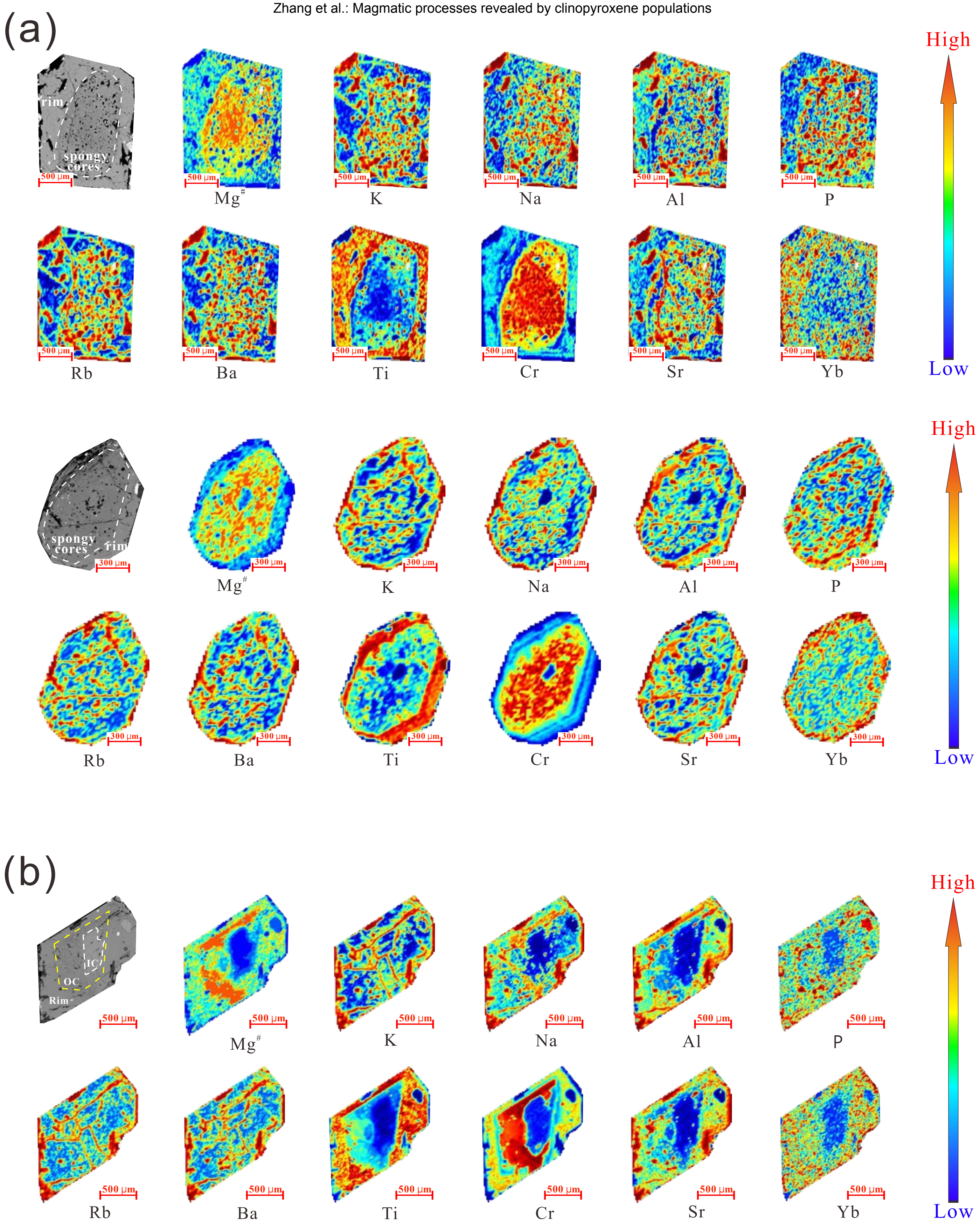
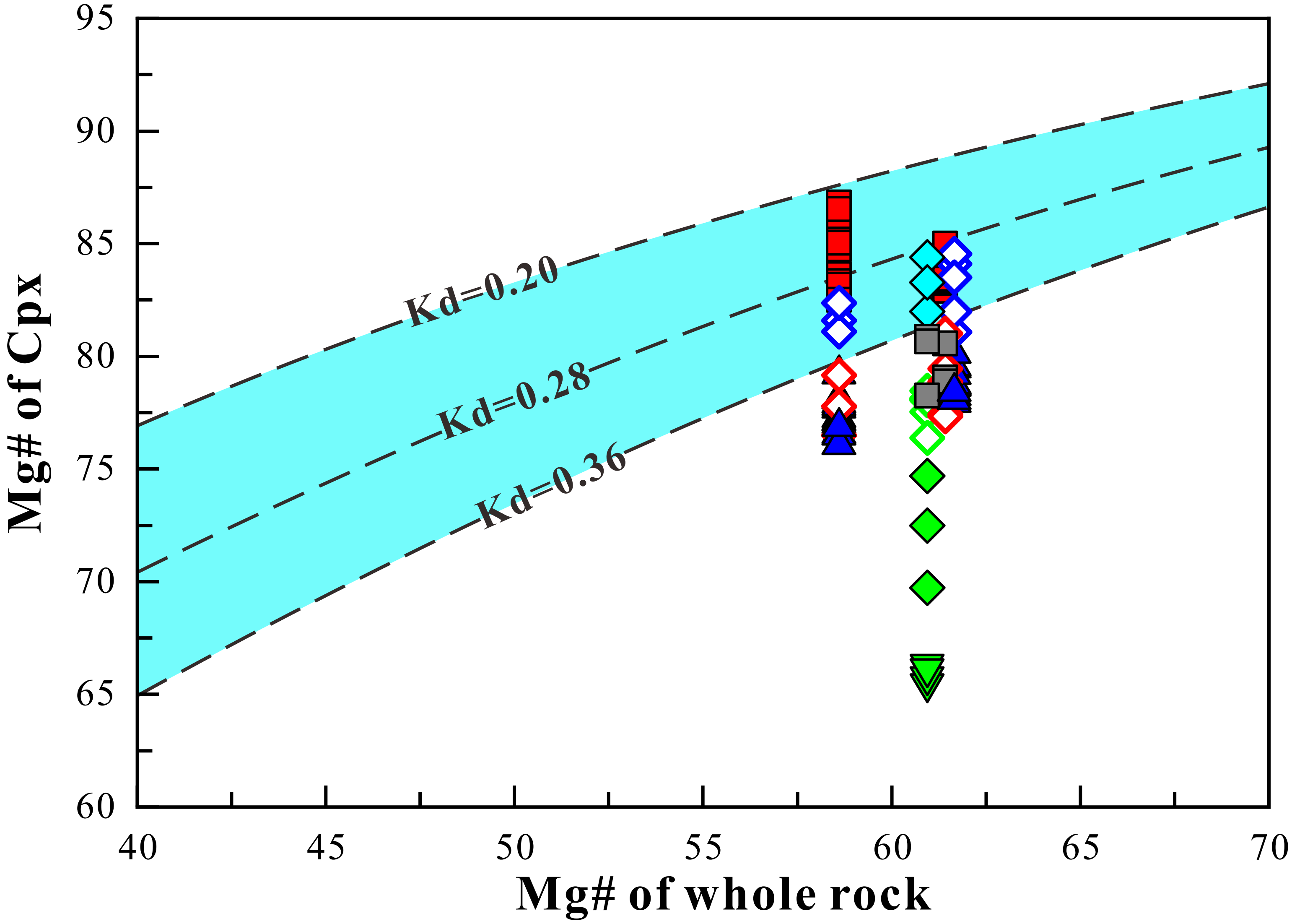


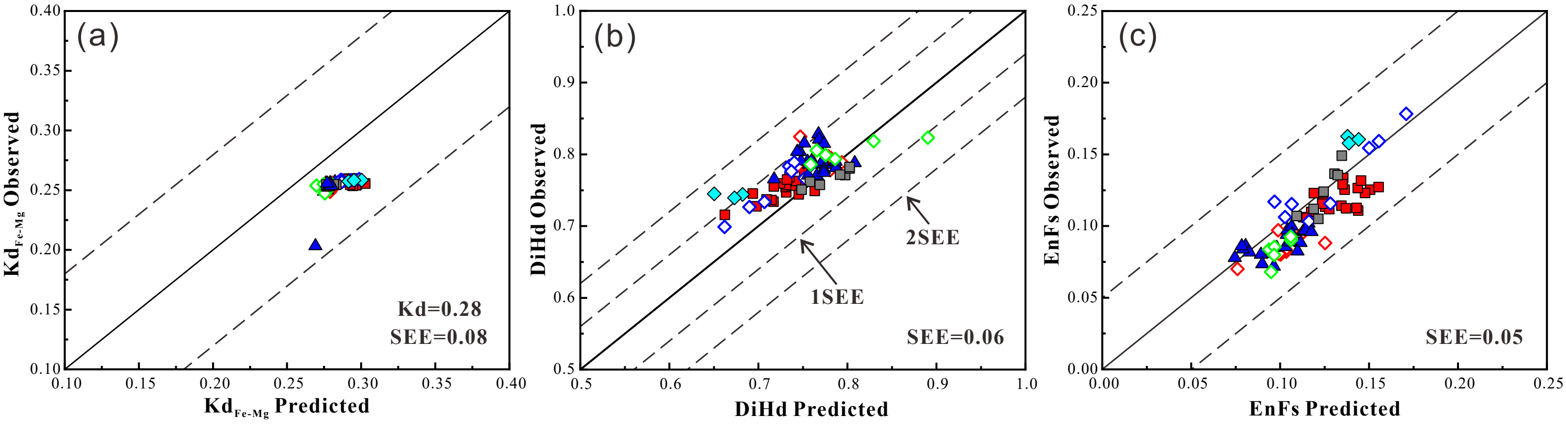
Supplementary Figure 1 TAS diagram showing that the Cenozoic basalts from West Qinling are mainly alkali basalts. Data of the previous study are Cenozoic potassium basalts from Yu et al. (2009).



Supplementary Figure 2 Trace element maps of Type–1 Cpx (a) and Type–3 Cpx (b).



Supplementary Figure 3 Equilibrium tests between clinopyroxenes and host samples. The Fe-Mg exchange coefficients: KD[Fe-Mg]Cpx-melt = 0.28 ± 0.08 (Putirka, 2008). The symbols are the same as in Figure 3.



Supplementary Figure 4 Comparison between the predicted and observed compositions (KD[Fe-Mg]Cpx-melt, DiHd, EnFs) of clinopyroxenes, using the methods of Putirka (1999). Standard errors are shown as dashed lines. The symbols are the same as in Figure 3.

Analytical method for bulk-rock major composition analysis

After a detailed petrographic examination, 20 fresh samples were selected and ground to less than 200 mesh with an agate mill. For the whole-rock major element analysis, the samples were prepared and fused as glass disks at the Guangzhou Institute of Geochemistry, Chinese Academy of Sciences. The major element oxides were determined using a Rigaku ZSX Primus X-ray fluorescence (XRF) spectrometer at the Guangdong Provincial Key Lab of Geological Processes and Mineral Resource Survey. The USGS rock standards and Chinese national rock standards AGV–2, BHVO–2, GSR–1, GSR–2, GSR–3 and GSD–9 were used to calibrate the elemental concentrations of the measured samples. The analytical precision and accuracy are better than ±5%.

Description of whole-rock major composition

The major element concentrations of the MJG basalts are listed in Table S1. These basalts are characterized by high contents of alkali elements (K_2O+Na_2O = 4.42–6.12 wt. %) and classified as alkali basalts based on the Rittman index (4.82–8.13). The majority of the samples have loss on ignition (LOI) values of less than 1 wt. %, suggesting they have not undergone significant alteration. The basaltic samples have higher MgO (9.80–11.07 wt. %; Mg# of 58.5–63.7) and $Fe_2O_3^T$ (12.19–12.85 wt. %) but lower TiO_2 (2.70–2.89 wt. %) contents than the trachybasalts. All the samples have homogeneous compositions and a narrow range in SiO_2 (47.01–47.86 wt. %), Mg# (58.5–63.7).