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Geochemical and isotopic data of Zheduo-Gongga granitic intrusive complex, eastern margin of the Tibetan Plateau: no evidence for middle-lower crustal flow

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Introduction

Geophysical studies have shown that middle-lower crustal flow started from central Tibetan Plateau may exist in the eastern margin of the Tibetan Plateau, which controls the mountain building, crustal thickening and deformation (Schoenbohm et al., 2006; Bai et al., 2010; Bao et al., 2015). However, no geological and petrological evidence have been presented. We carried out detailed studies on the geochemical and isotopic compositions of the Mesozoic-Cenozoic Zheduo-Gongga granitic intrusive complex on the easternmargin of the Tibet Plateau. These granitoid rocks include ~210-200 Ma Gongga monzogranite and granite, ~175 Ma Zheduo porphyritic to coarse-grained granite, ~50 Ma Zheduo gneissic granite, ~38-28 Ma Zheduo gneissic monzogranite, and ~6-3 Ma Zheduo fine-grained monzogranite and leucogranite.

Geological background

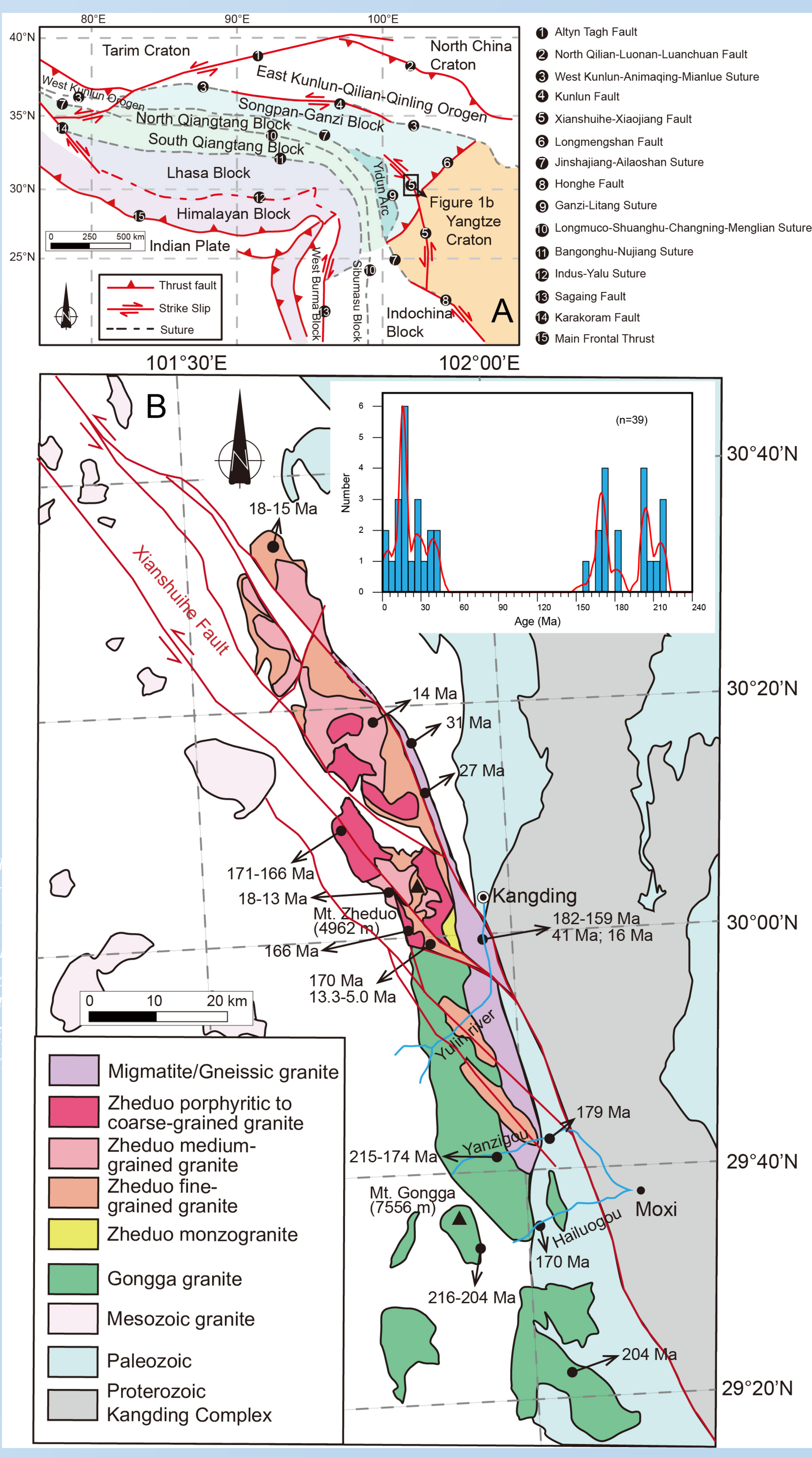


Figure 1. Location of the Zheduo-Gongga (ZD-GG) granitic intrusive complex. (A) Location of the Zheduo-Gongga granitic intrusive complex in the eastern margin of Tibetan Plateau. (B) Simplified geological map of the Zheduo-Gongga granitic intrusive complex. After Li et al. (2015).

Outcrop features

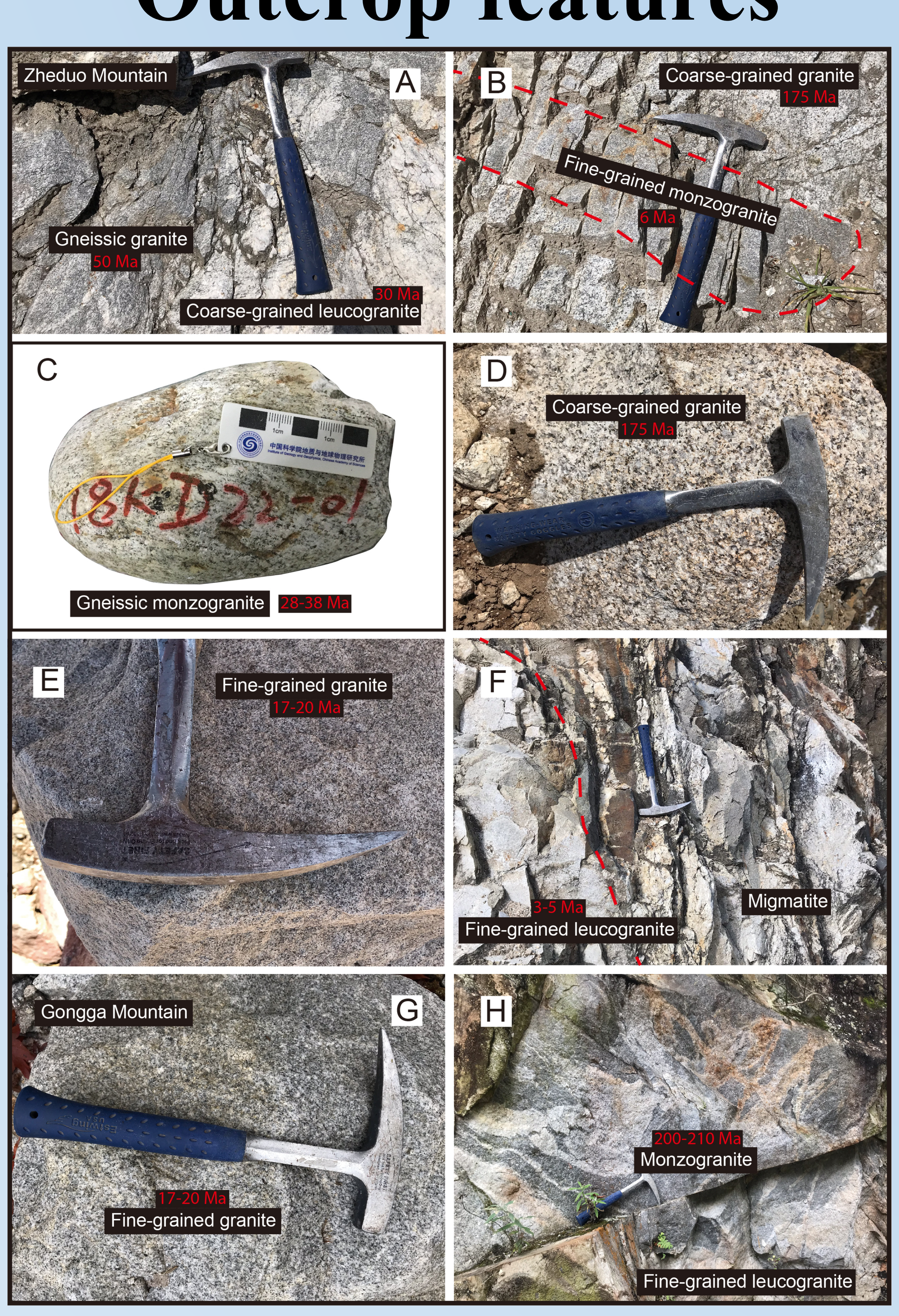


Figure 2. Outcrop features of the ZD-GG granitic intrusive complex. (A) ZD coarse-grained leucogranite intruded into gneissic granite. (B) ZD fine-grained monzogranite intruded into coarse-grained granite. (C) ZD gneissic monzogranite. (D) ZD coarse-grained granite. (E) ZD fine-grained granite. (F) ZD fine-grained leucogranite intruded into migmatite. (G) GG fine-grained granite. (H) GG monzogranite.

Isotopic features

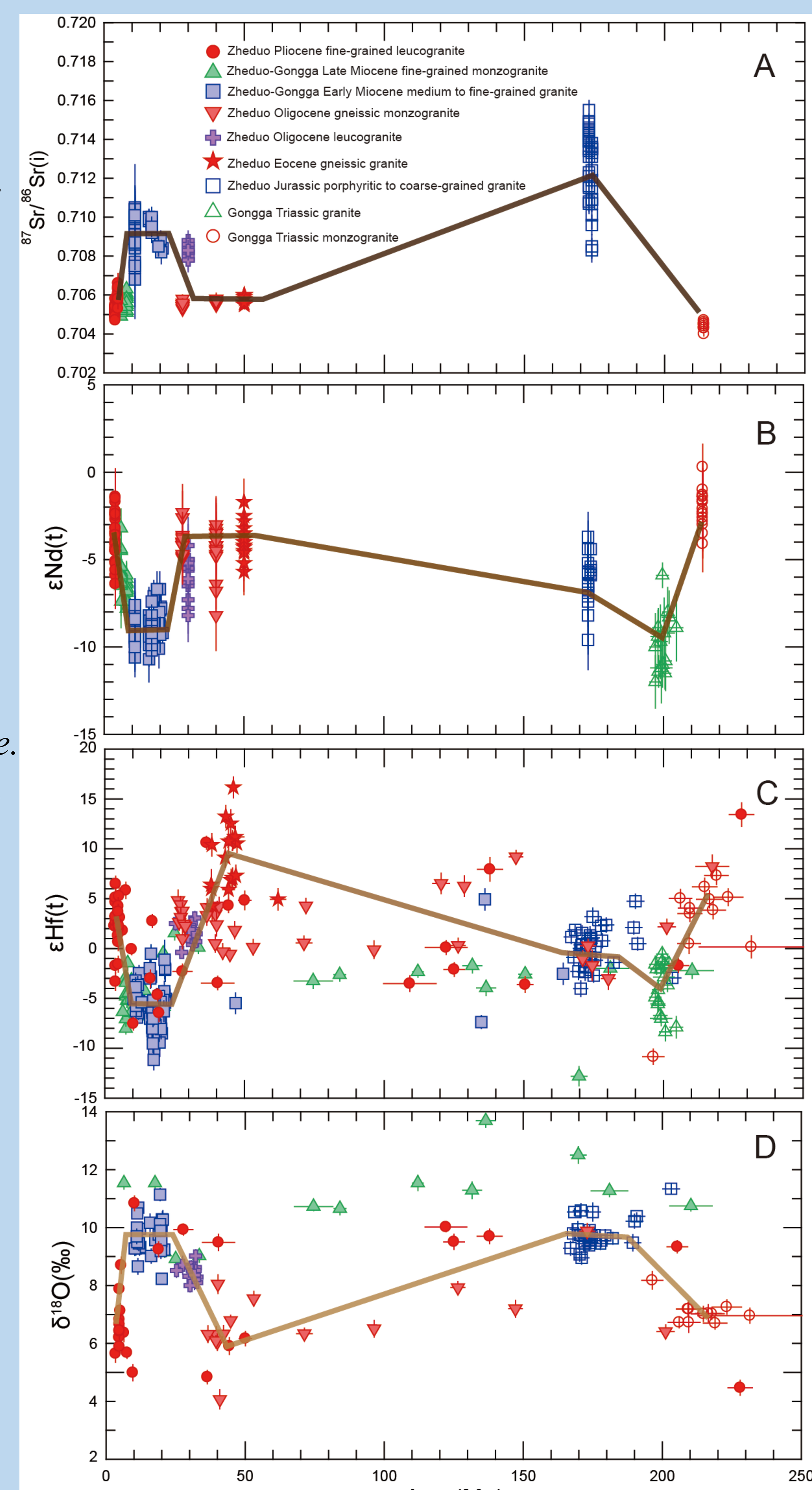


Figure 4. Isotopic data changes with time. (A) $^{87}Sr/^{86}Sr$ data of plagioclase. (B) εNd(t) values of apatite. (C) εNd(t) values of zircon. (D) $\delta^{18}O$ values of zircon.

Sr-Nd-Hf-O isotopic data of granitic rocks from the ZD-GG intrusive complex show compatible changes with time from the Late Triassic to Pliocene.

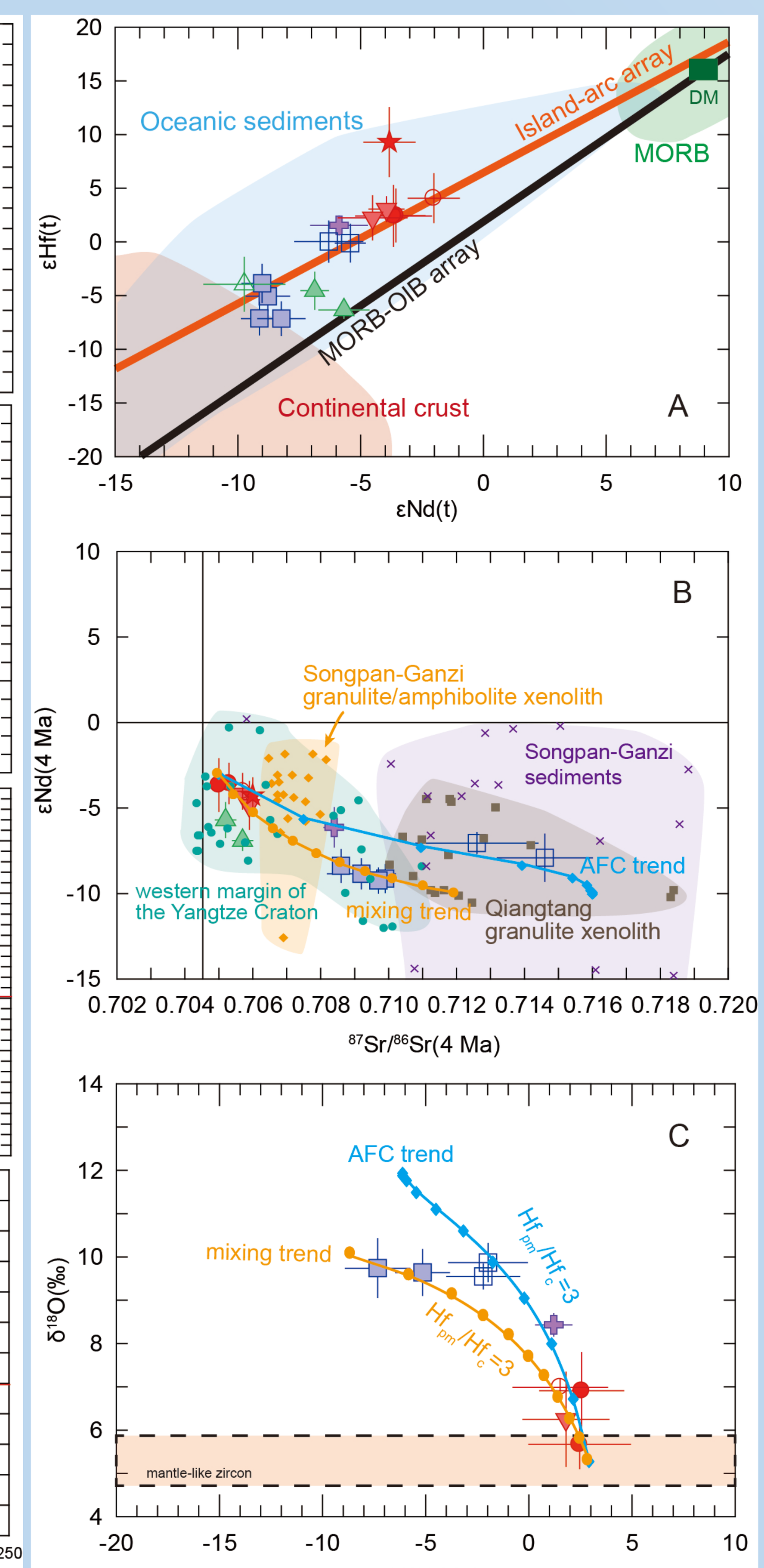
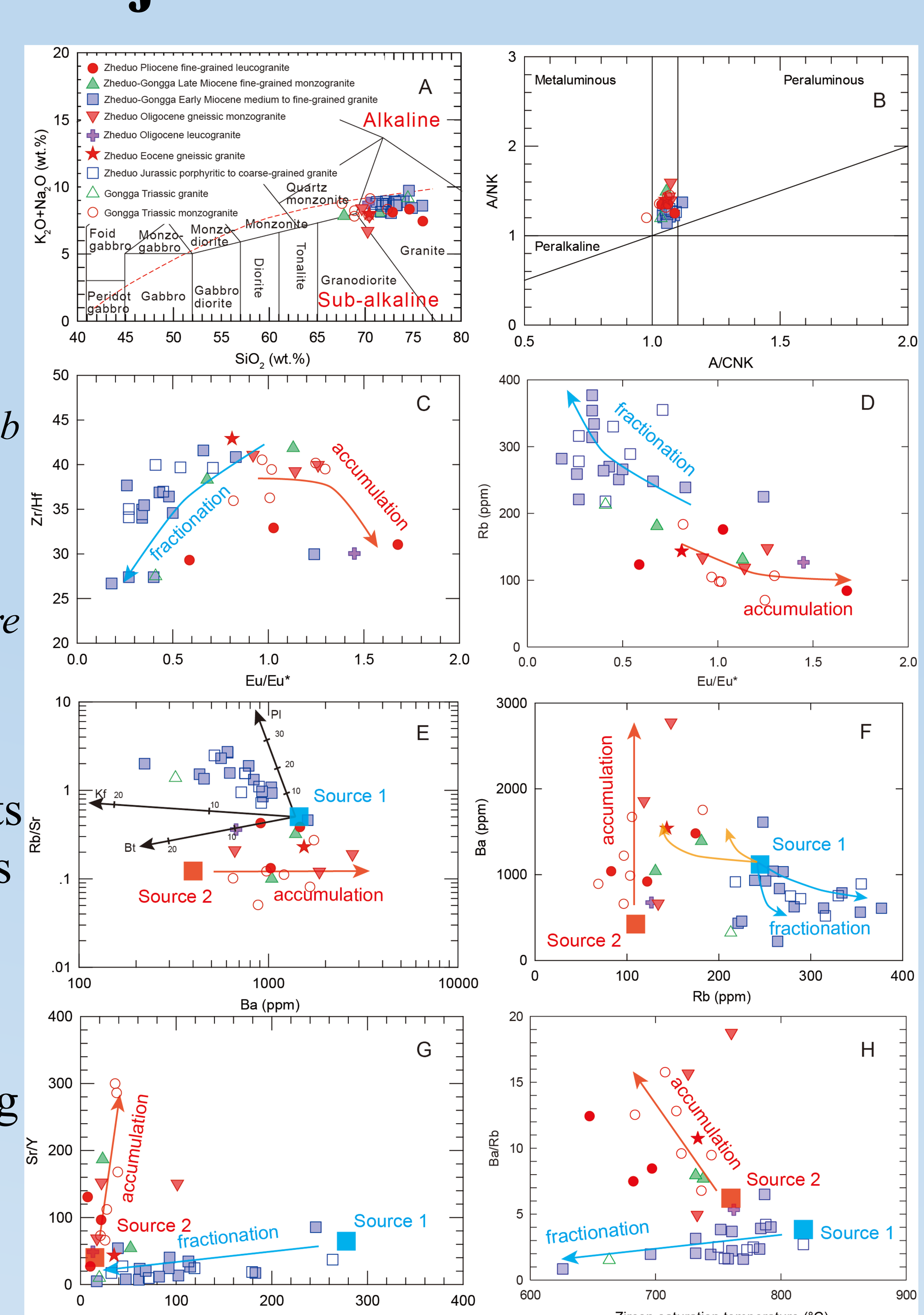


Figure 5. Isotopic features of different sources. (A) εNd(t) vs. εNd(t) reflecting Hf-Nd decoupling. (B) εNd(4 Ma) vs. $^{87}Sr/^{86}Sr$ (4 Ma). Data from western margin of the Yangtze Craton (Zhao and Zhou, 2007; Huang et al., 2009; Du et al., 2014; Chen et al. 2015); Songpan-Ganzi xenolith (Wang et al., 2016); Songpan-Ganzi sediments (She et al., 2006; Sigoyer et al., 2014); Qiangtang xenolith (Lai et al., 2007). (C) $\delta^{18}O$ vs. εHf (4 Ma).

Sr-Nd-Hf-O isotopic data show that primarily sources are basement of western margin of the Yangtze Craton and Songpan-Ganzi sediments.

Major and Trace elements

Figure 3. Major and trace elements of ZD-GG granitic intrusive complex. (A) Total alkali vs. SiO_2 (Middlemost, 1994). (B) A/NK vs. A/CNK (Maniar and Piccoli, 1989). (C) Zr/Hf vs. Eu/Eu ($Eu_N/(Sm_N+Gd_N)$^0.5). (D) Rb vs. Eu/Eu*. (E) Rb/Sr vs. Ba. (F) Ba vs. Rb. (G) Sr/Y vs. $(La/Yb)_N$. (H) Ba/Rb vs. Zircon saturation temperature (Boehnke et al. 2013).*



Major and trace elements of ZD-GG granitic rocks show that 2 different evolution trends (fractionation vs. accumulation), reflecting 2 different potential sources. Source 1 may be meta-sedimentary rocks. Source 2 may be metaigneous rocks.

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Conclusions

1. **Episodic magmatism since the India-Asia collision in the eastern margin of the Tibetan plateau and could be compatible to the Mesozoic magmatism in the same area.**
2. **Whole-rock geochemistry and mineral isotopic features indicate two different sources are mainly involved in their formation, including basement of western margin of the Yangtze Craton and Songpan-Ganzi sediments.**
3. **Juvenile magma generated during the Pliocene argues against the transportation of middle-crustal materials from the central Tibet to the eastern margin of the Tibetan Plateau.**

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