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Geochemical comparison between Cenozoic intraplate basalts from Indochina Peninsula and Southeast China

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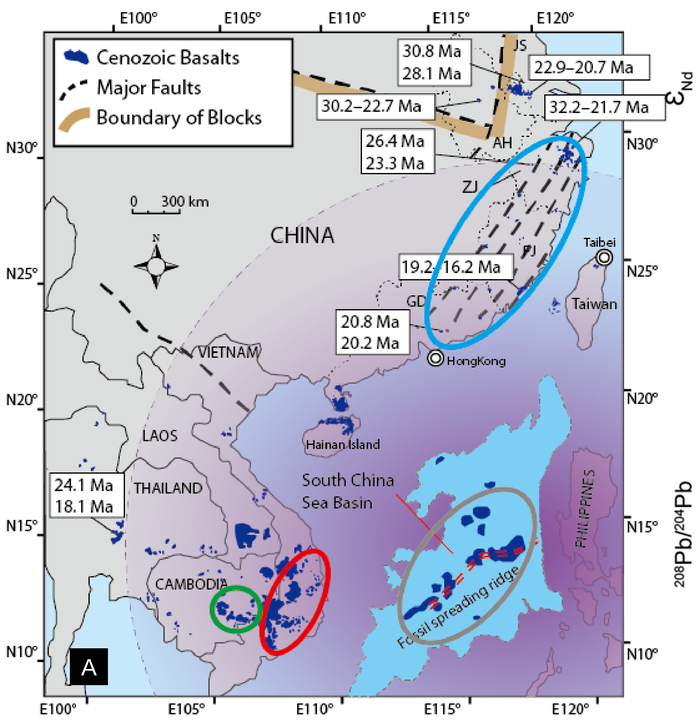
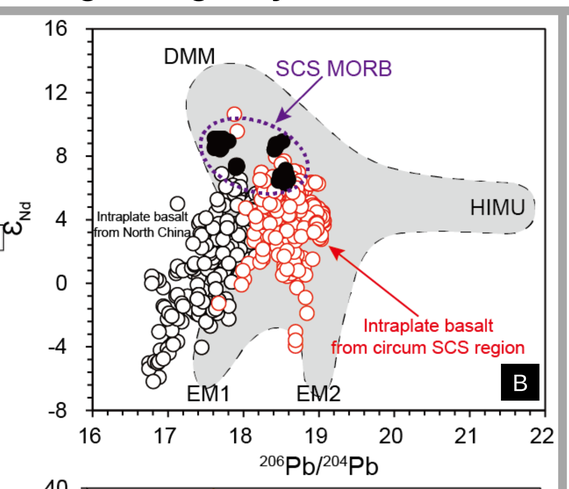
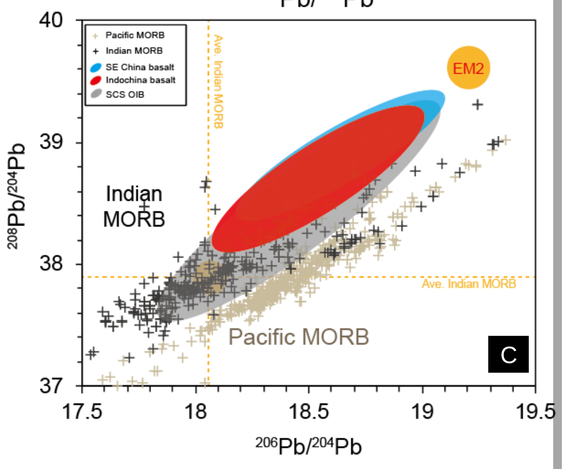
Abstract: Continental intraplate basalts from the South China Sea region show OIB-type geochemical signatures, which are characterized by binary mixing between Depleted MORB Mantle (DMM) and EM2 enriched mantle component in terms of isotopes. Origin of the enriched component is debating including sub-continental lithospheric mantle, recycled oceanic crust, and Hainan plume. Here we present major and trace elemental compositions and Nd isotopes for basalts from southern Vietnam and eastern Cambodia to uncover the origins of their mantle source. We propose that the geochemical signal of enriched component is derived from the inconsistent melting of carbonated mantle and recycled oceanic crusts, and provide implication for understanding the regional geodynamics.

1. Background of the study

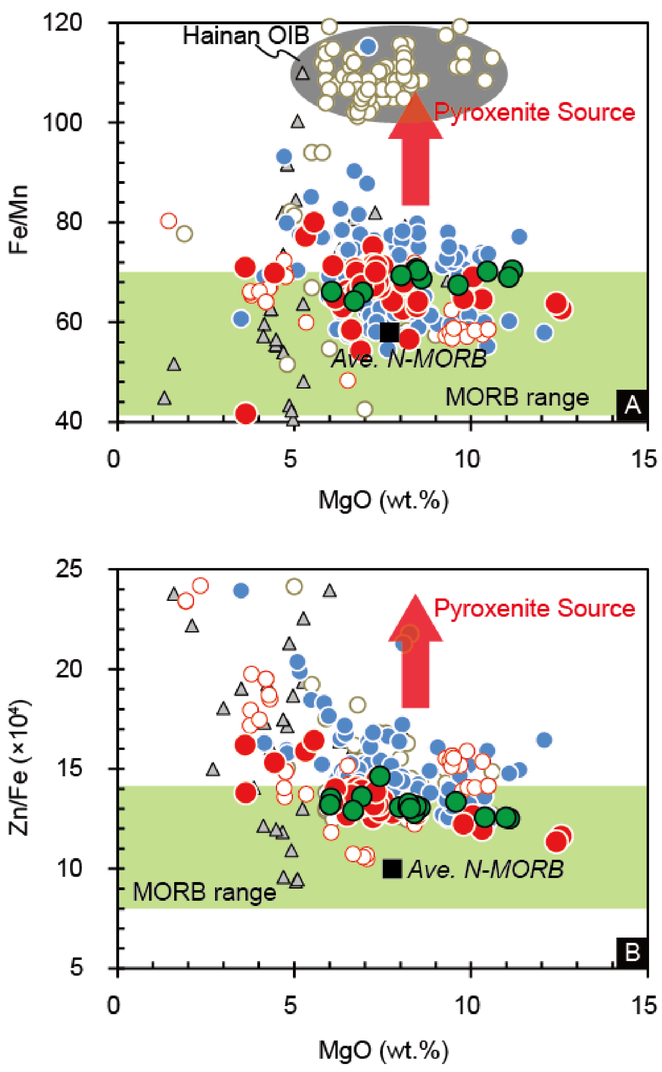






Cenozoic intraplate volcanisms are widely distributed within a distance of the South China Sea. They are featured by (1) similar ages of eruption (< 16 Ma), (2) similar binary mixing trends between DMM and EM2, and (3) similar isotopic variation in terms of Pb isotopes. In summary, all volcanisms share a lot of similarities. However, their tectonic significance is still debating and unclear.

3. A similar pyroxenitic component in mantle sources



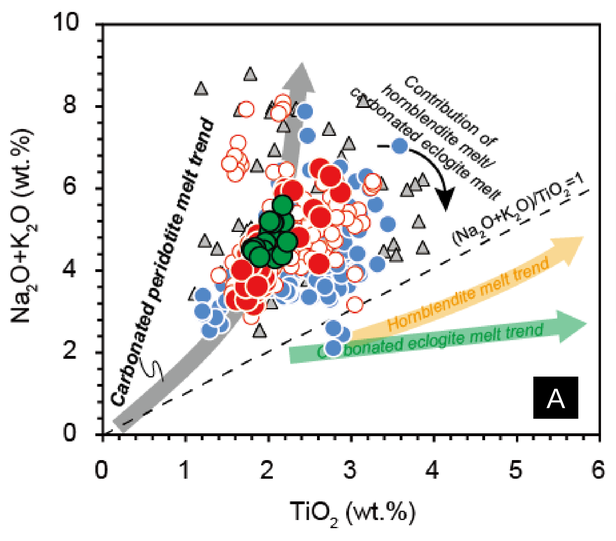
Peridotite source has low Fe/Mn (42-70) and Zn/Fe (×10⁴, 8-14) ratios, while pyroxenite source has higher Fe/Mn and Zn/Fe ratios.

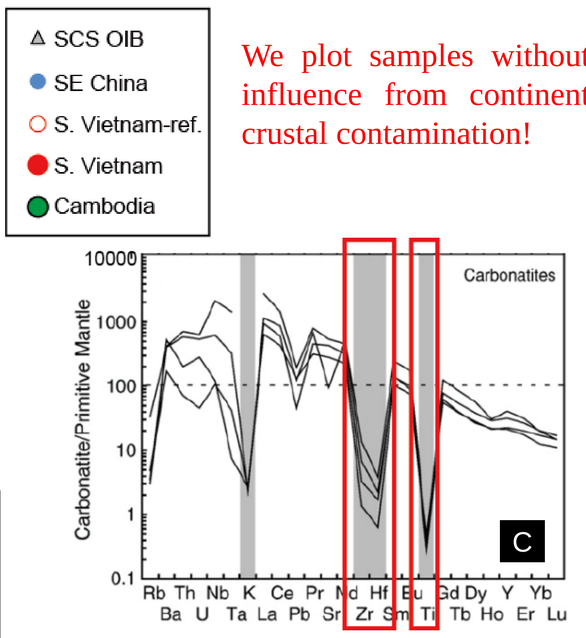
Mantle source of basalts from Southeast China was reported to contain pyroxenite component in addition to peridotite mantle.

Similar to Southeast China basalts, basalt samples from southern Vietnam and eastern Cambodia have higher than normal Fe/Mn and Zn/Fe ratios.

2. A shared carbonated component in mantle sources

Method: We present major and trace elemental compositions, along with Nd isotopes, of new samples from southern Vietnam and eastern Cambodia. By comparing with well studied basalts from Southeast China, we intend to understand the petro-genesis of them and imply the tectonic significance.





We plot samples without influence from continent crustal contamination!

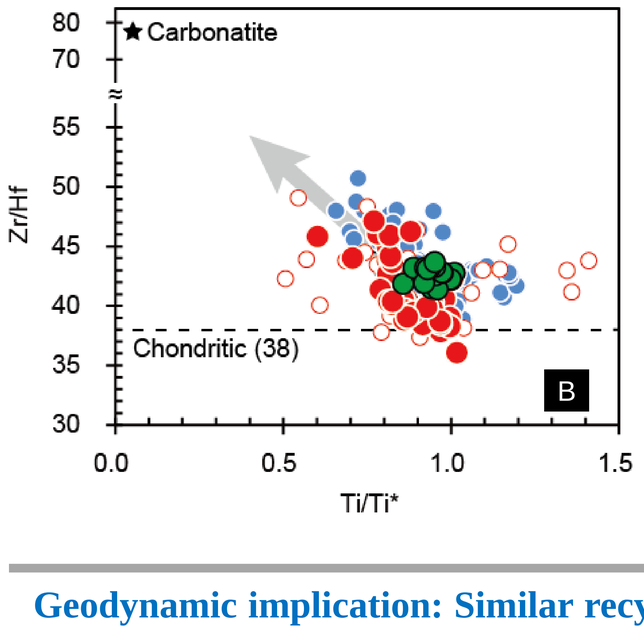
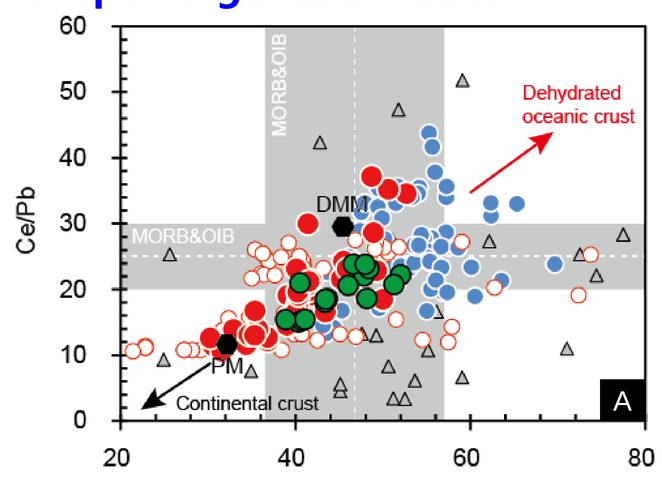


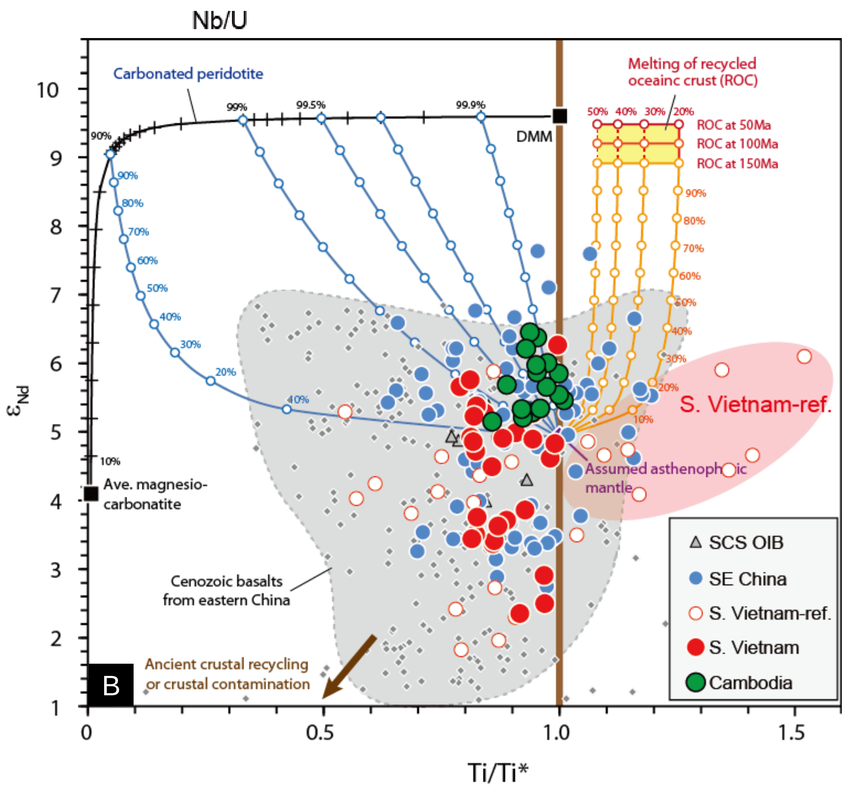
Figure A shows the comparison with major elemental compositions of high-T and high-P experimental results.

Figure B and C tell us that carbonated components should be present in sources of basalts in study region since carbonated mantle is characterized by negative Zr, Hf, and Ti anomalies.

4. A petro-genesis model



Recycled oceanic crusts and sediments should be contained in mantle sources of southern Vietnam and eastern Cambodia basalts, which is similar to Southeast China basalts.



A geochemical modelling can be built to interpret the petro-genesis of all intraplate basalts by inconsistent melting of a hybrid mantle.

Geodynamic implication: Similar recycled carbonates and oceanic crusts are observed in sources of intraplate volcanisms surround the South China Sea, which cannot be explained by contamination of sub-continental lithospheric mantle. Since intraplate volcanisms from the Southeast China can hardly be explained by influence from Hainan plume, we suggest a ridge-suction induced upper mantle convection model is most likely to explain the regular distribution of intraplate volcanisms in time, space, and geochemistry in the South China Sea region since Miocene.