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Mg–Zn isotopes reveal spatial changes of carbon input in subduction zone

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Subduction zone is the dominant location of deep carbon cycling on the earth. However, the carbon input type and the cycle efficiency vary greatly in the different subduction zone around the globe (*Plank and Manning, 2019*), this process has rarely been verified in the single subduction zone. NE Asian continental margin recorded the subduction history of the Pacific slab with moderate water and carbon flux, which provides the possibility to verify spatial changes of carbon input. Mg-Zn isotopes, as a powerful tool, have been widely used to tracing carbonate dissolution because carbonate dissolution was verified as the dominant mechanism for carbon removal up from subduction slab to the mantle through slab fluids (*Farsang et al., 2021*). The available Mg-Zn isotopic data for the Miocene basaltic rocks in the NE China and Russia Far East recorded the prominent difference in carbonate dissolution in space. The Miocene basaltic rocks from the northern part of NE Asia exbibit a coupled Mg-Zn isotopic signature, implying that high recycling efficiency of carbonate dissolution during subduction happened. This process is also supported by the absence of wehrlite xenoliths within the Miocene basalts in this area. In contrast, the decoupled Mg-Zn isotopic signature of basaltic rocks can be observed in the southern part of NE Asia, indicating that the carbonate–bearing sediment had almost no carbonate dissolution during the subduction. The retained carbon deep cycling results in formation of the carbonated peridotite, which has been also verified by wide occurrence of the wehrlite xenoliths within the Cenozoic basalts in this area. This spatial variation of the carbon input in subduction zone can be attributed to subduction style and their temperature structure. Thus, we can conclude that the spatial changes of subduction style and temperature structure not only affect the carbon recycling efficiency, but also result in mantle heterogeneity.

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References

Farsang et al. (2021), Nature Communications 12: 4311.

Plank and Manning (2019), Nature 574: 343-352.