Mg isotopic evidence for recycling of supracrustal materials into the deep crust in the Dabie orogen, Central China

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In order to investigate recycling of supracrustal materials in collisional zones, we report Mg isotopic compositions for 52 early Cretaceous granitoids from the North Huaiyang zone (NHZ), the North Dabie zone (NDB), the Susong high pressure metamorphic zone (HPZ) of the Dabie orogen, Central China. The results show remarkably variable δ^{26}Mg from -0.54 to 0.43‰. Except for two samples, granitoids with SiO_2 < 70% possess homogeneous Mg isotopic compositions with an average δ^{26}Mg of -0.25±0.07‰ (2SD, n=36/52), consistent with limited Mg isotope fractionation during differentiation of granitic magma [1] and arguing against significant contribution from sedimentary components. By contrast, high-silica granites (SiO_2>70%) show most variable δ^{26}Mg values. The role of fluid exsolution can be excluded based on no correlation of δ^{26}Mg with fluid-activity-sensitive indices (e.g., Y/Ho, Th/U) and mass balance consideration. Biotite ± hornblende appear as the dominant Mg-carriers in high-silica granites, while fractional crystallization of these minerals may not significantly change δ^{26}Mg of the residual melt [1]. Although in principle fractional crystallization of isotopically heavy magnetite tends to decrease melt δ^{26}Mg, this process would also dramatically increase melt Mg#. Generally low Mg# (<23) of high-silica granites thus argue against the role of substantial magnetite crystallization. Overall, variable δ^{26}Mg observed in the high-silica granites most likely reflect source heterogeneity. When projected along a suture-crossing transect of the orogen, most granites with δ^{26}Mg fractionated from the upper mantle values distribute near the suture of the orogen (the Xiaotian-Mozitang fault) and especially in the NHZ. This implies recycling of supracrustal materials, e.g., both isotopically light carbonate and heavy clastic sediments, into the deep crust near the suture by collision. Decarbonation of the carbonated sources in sometime between the Triassic collision and early Cretaceous magmatism may have emitted substantial amount of CO_2 and contributed to the greenhouse in that era.

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