The ^{11}B-depleted fluids expelled from a highly dehydrated slab in the forearc: A snapshot of slab roll-back?

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Accretionary orogens form along convergent plate margins due to the ongoing subduction of oceanic lithosphere. Based on the dips and velocities of subducting slabs, accretionary orogens can be divided into retreating and advancing type, as exemplified by modern SW Pacific and Andes, respectively. As the largest accretionary orogen in the world, the Central Asian Orogenic Belt (CAOB) has been considered to form in a way resembling modern SW Pacific. Hence, the retreat of downgoing slab (i.e., slab roll-back) could have played an important role in the development of the CAOB. However, recognition of the retreat of a subducted slab is difficult in an ancient orogenic belt due to the lack of geophysical data. One way to recognize this process is to identify deep-derived fluids in the forearc. Here we present new whole-rock B isotopic data for late Carboniferous dioritic dykes in the Langwashan arc from the Beishan area, southern CAOB, aiming to investigate what kinds of slab-derived fluids modify the mantle wedge. The dioritic dykes are calc-alkaline and sodium-rich. Their Sr–Nd isotopic features (initial $^{87}Sr/^{86}Sr$ = 0.7039–0.7046; $\varepsilon_{Nd}(t)$ = 3.0–4.3) and arc-like geochemical signatures (enrichments of large ion lithophile elements and depletions of high field strength elements) indicate that they were likely derived from hydrous melting of lithospheric mantle with significant crystal fractionation. The dioritic dykes have relatively lower $\delta^{11}B$ values (–7.7 to –6.4‰) than that of MORB ($\delta^{11}B \approx -4$‰), reflecting that their mantle source has been hybridized by ^{11}B-poor fluids released from a highly dehydrated slab at deep depths. Considering the dykes from the forearc, it is proposed that metasomatism of subarc mantle by deep-derived fluids could be a snapshot of slab roll-back.