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Trace-element mobilities due to reactive fluid flow: insights from dehydrating blueschists (Tianshan, China)

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The mafic high-pressure rocks of the Tianshan (NW China) display an interconnected network of eclogite-facies veins derived by prograde blueschist dehydration. They provide insight into fluid-rock interaction and element load during long-distance fluid flow occurring due to the major fluid release of subducting oceanic crust. This case study focuses on an eclogite-facies transport vein, its blueschist host and the reaction zone (blueschist-alteration zone), which is located in the central part of the vein. The blueschist mainly consists of glaucophane, micas, epidote, dolomite and garnet while the vein consists of omphacite, quartz and apatite. Within the blueschist-alteration zone glaucophane, paragonite and dolomite have been replaced by omphacite and garnet. Rock textures indicate that the infiltration of external fluids produced the transport vein, most likely due to hydraulic fracturing. These fluids also triggered the eclogitization of the blueschist-alteration zone. The almost twice as high Li concentration of the vein and the blueschist-alteration zone in comparison to the blueschist host supports the assumption of an external origin of the fluids. The low in trace element vein-forming fluid caused a strong mobilization of all trace elements in those parts of the host the passing fluid reacted with. 40-80 % of the trace elements were scavenged which coincided with a loss of the large-ion-lithophile- and light-rare-earth-elements (LILE and LREE), almost double the loss of the heavy-rare-earth and high-field-strength-elements (HREE and HFSE). Around 75% of the total carbon was released as CO2 into the reactive fluid. The main difference between the blueschist host and the blueschist-alteration zone is the replacement of glaucophane, dolomite, and titanite by omphacite, garnet, and minor rutile respectively, whereas garnet, epidote,

rutile, and phengite occur in both zones of the rock. Therefore, the fluid-flow regime rather than the mineral assemblages and equilibrium partition coefficients controls the trace element mobility. The mobilized trace elements coincide with those needed to create the slab signature of arc magmas.