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What is the role of subduction in the flood basalt origin?: Siberian Traps case study

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Experimental data combined with numerical calculations suggest that fast subducting slabs are cold enough to carry into the deep mantle a significant portion of the water in antigorite, which transforms with increasing depth to phase A and then to phase E and/or wadsleyite by solid-solid phase transition. Ice VII and clathrate hydrates are also stable at PT conditions of cold slabs and represent other potential phases for water transport into the deep mantle. Some cold slabs are expected to deflect while crossing the 410 km and stagnate in transition zone being unable to penetrate through 660 km discontinuity. In this way slabs can move a long way beneath continents after long-lived subduction. With time, the stagnant slabs are heated to the temperature of the ambient transition zone and release free H2O-bearing fluid. Combining with transition zone water filter model this may cause voluminous melting of overlying upper mantle rocks. If such process operates in nature, magmas geochemically similar to island-arc magmas are expected to appear in places relatively remote from active arcs at the time of their emplacement. Dolerites of the south-eastern margin of the Siberian flood basalt province, located about 700 km from suggested trench, were probably associated with fast (cold) subduction of the Mongolia-Okhotsk slab and originated by dehydration of the stagnant slab in the transition zone. We show that influence of the subduction-related deep water cycle on Siberian flood basalt magmatism gradually reduced with increasing distance from the subduction zone. Supported by RFBR 08-05-00642 and 08-05-98104.