

Pervasive hydrous carbonatitic liquids mediate transfer of carbon from the slab to the subarc mantle

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Carbonatitic liquids, as a medium for transferring carbon from the slab to the mantle at subarc depths, are thought to be restricted either to the hottest conditions or to be the hydrous melting of calcium-rich lithologies (i.e., carbonated gabbro and limestone rocks) in subduction zones. In this study, high-pressure experiments on carbonated hydrous pelites demonstrate that while silicate melts are produced at 2.5–4 GPa, hydrous carbonatitic liquids clearly dominate at 5–6 GPa. The stability of Ca-rich carbonate is strongly depressed by water at pressures exceeding ~4 GPa, promoting the formation of hydrous carbonatitic liquids at temperatures as low as ~850–900 °C; these temperatures correspond to intermediate thermal regimes at depths of 150–180 km. Hence, carbonatite production beneath arcs is more pervasive than previously thought, and the carbon cycle is most likely confined to depths of less than 200 km for many subduction zones.