The role of selective assimilation of metapelitic crust in the generation of fayalite granitoids

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Fayalite granitoids were found in the late Triassic Cobquecura Pluton, at the Pacific continental margin of South America (Chile, ~36°S, ~72°45'W). The pluton consists of comagmatic gabbroic, fayalite-bearing and fayalite-free granitoid rocks. Fayalite granitoids are commonly thought to have crystallized from H_2O-poor and reduced magmas with f_{O2} even lower than the fayalite-magnetite-quartz buffer. The major and trace element patterns of the Cobquecura Pluton moreover show that the fayalite granites are a product of open-system fractional crystallization from the comagmatic mafic magmas of this suite. The mafic source is similar in composition to the regional subarc-subcontinental mantle. Both fayalite-bearing and fayalite-free granitoids exhibit Sr-Nd isotopic compositions that differ from signatures of both the mantle and the known crustal sources of the regional Paleozoic Basement.

In the Cobquecura Pluton, Fe–rich restitic xenoliths (spinel-cordierite-quartz-plagioclase) were discovered. They originate from a deeper level (probably middle crust) than currently exposed at the surface. The occurrence of leucosome together with restite in the xenoliths indicates anatectic processes, which may have facilitated selective assimilation processes. Differences in the leucosome composition of the restitic xenoliths included in rocks of the Cobquecura Pluton suggest at least two types of restitic xenoliths: a feldspar-rich, accessory minerals-poor leucosome in leucosome-rich xenoliths (HLRX; high leucosome restitic xenoliths), and a feldspar-poor, accessory mineral-rich leucosome in leucosome-poor xenoliths (LLRX; low leucosome restitic xenoliths). The HLRX are only present in fayalite-free granitoids, whereas the LLRX occur in gabbros and fayalite granitoids. We describe close geochemical correlations between LLRX and fayalite granitoids, namely with respect to REE patterns, compatible element contents, and Pb isotopic signatures. These correlations point to a selective assimilation of Fe-rich continental crust, compositionally similar to the LLRX, as an important process in fayalite granitoid petrogenesis, an aspect that has not yet gained much attention in the fayalite granitoid literature. The fayalite-free granitoids could have been generated through the assimilation of melts similar to the leucosomes of the HLRX.

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