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Short-range local equilibrium in pelite-granodiorite assimilation in experiments and nature. An example from the Gredos batholith, Central Spain

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Some granodiorite and monzogranite rocks related to calc-alkaline associations, with Hbl-bearing facies and diorites with abundant mafic microgranular enclaves (I-type granites) may have locally large euhedral crystals of cordierite (Cord). The paradoxical occurrence of this typically anatectic mineral in non-anatectic granites, in apparently textural equilibrium but far from chemical equilibrium with the hosting magma has been the object of intense debate. We show here new experiments that simulate the process of pelite assimilation by granodiorite magma following inferences from detailed field relations in the Gredos batholith of Central Spain. Our data strongly support the formation of Cord at local equilibrium in places of high Al activity around partially or totally digested pelitic xenoliths. We show that Cord-bearing granodiorites are out of the cotectic liquid line of descent of the calc-alkaline association in this particular example of the Variscan belt in Spain. A first order estimation of the amount of assimilated crust yields that about 20 wt% of the volume of the batholith is acquired by assimilation in local areas close to the contacts. We also show that the process is strongly dependent on the emplacement mechanism and the geometry of the intrusions. Although local, the identification of these processes is important in order to assess the relative role played by granite magmatism in crustal reworking during orogenesis.