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In situ observation of texture formation in partially melted metapelitic granulites: the xenoliths of the Neogene Volcanic Province of SE Spain

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Our understanding of reaction mechanisms and texture formation in lower crustal, anatectic rocks is limited by melt extraction and the reequilibration processes (e.g., the crystallization of melt, back-reactions between melt and restite) that natural granulites and migmatites commonly undergo during slow cooling and exhumation. The alternative approach of experimental simulation has the limitations of producing minerals with grain sizes which are several orders of magnitude finer, and of using rates which are several orders of magnitude faster, than in nature.

Here we report on the studies of exceptional metapelitic xenoliths within El Hoyazo dacites in SE Spain, which were rapidly brought to surface within the host volcanics from a partially melted state down in the continental crust. They can confidently be considered, therefore, as true examples of the behaviour of lower to mid-crustal rocks during their partial melting, and may help overcome the above mentioned limitations on textural studies and reaction mechanisms.

We have observed the following melt-related textures:

- syn-anatectic foliations: melt inclusions in plagioclase outline foliations showing crenulations or anastomosing around garnet with primary glass inclusions. These foliations must have formed when melt was present in the rock, and likely document syn-anatectic differential stress, which is important for melt extrac-

tion processes.

- strain-solution during garnet growth: elliptical garnets in highly deformed xenoliths display microstructural and inclusion patterns which are compatible with strain-solution processes in the presence of melt.
- growth of porphyroblasts with inclusions of glass: primary glass inclusions are common in garnet, plagioclase, cordierite, hercynite, ilmenite, zircon and monazite, and indicate that these minerals have grown in the presence of melt because of either incongruent melt production or retrograde melt consuming reactions.
- development of reaction rims during biotite melting: thin rims of hercynite, ilmenite and glass around resorbed biotite allow modelling and mass balance of the biotite melting reaction in Qtz-free systems.
- development of Spl-Crd-Kfs-melt coronae around garnet: these textures and their mineral chemistry provide information on one important reaction of low-pressure granulites.
- distribution of interstitial glass: interstitial glass occurs mostly as layers parallel to the Bt-Sil-rich foliation, indicating that melt escaped from the metapelites mainly by flow along foliation planes during ductile deformation.

These textures are of relevance for the behaviour of rapidly heated low- to mid-pressure granulites, as in thinning continental crust undergoing magmatic underplating. We compare our findings with microstructures from natural granulites and migmatites from the Ivrea Zone, the Kerala Khondalite Belt and Broken Hill, and from experimental runs, and point out analogies with the aim of defining textural criteria for the recognition of partially melted metapelites.