Leucosome distribution method and geochemical melt modelling in Masku migmatites, SW Finland

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Partial melting processes have been shown to follow power law distribution (e.g. Soesoo et al., 2004) and behave as self-critical systems (Soesoo & Bons, 2015). Leucosome distribution in migmatites of metasedimentary origin often follows the simple power law function $N_{>S} = kS^{-m}$, where $N_{>S}$ is the number of leucosomes thicker than width S, k the number of leucosomes larger than unit size and m the distribution exponent (fractal dimension). If the power law exponent m is $\sim$1, the melt extraction has been inefficient (majority of the melt is found in small leucosomes). If the exponent is about 2/3, the melt extraction is effective ($\sim$50% of the melt is found in large melt batches).

Leucosomes of migmatites at the classical "Masku Riviera" outcrop, south-western Finland, were measured and their cumulative width distribution plotted on a log-log graph, after which a power-law function was fitted to the data. Our results evidence two power-law regimes with different power-law distributions. For larger leucosomes (width $\geq$10 mm) it seems that melt extraction was inefficient. However, the data for thinnest leucosomes (width $\leq$ 9 mm) suggest effective melt extraction.

Geochemical analysis of leucosome and palaeosome (assumed protolith) samples from the Masku area shows that the leucosome is slightly enriched in REE, with the exception of HREE, in comparison to the palaeosome. Numerical models of modal batch melting of the palaeosome show that 60% melting of the paleosome results in about the same REE contents as the leucosome sample has.

References:

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