Partial melting of basic dykes in the contact aureoles of two shallow-level, gabbro-pyroxenite intrusions, Fuerteventura

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Low-pressure anatexis of basic dykes gave rise to unusual, zebra-like migmatites, in the contact metamorphic aureoles of two layered gabbro-pyroxenite intrusions, PX1 and PX2, in the root zone of an ocean island, Fuerteventura Basal Complex (Canary Islands). This thesis focuses on the understanding of processes attributing to the partial melting and formation of these migmatites, characterised by a dense network of closely spaced, millimetre-wide leucocratic segregations with perfectly preserved igneous textures.

The presence of fluids are required to decrease the solidus of basic igneous lithologies, to allow partial melting in such a low-pressure (1-2 kb) environment. An oxygen isotope study was thus carried out on dykes inside and beyond the PX2 aureole, in order to decipher the nature and origin of such fluids. Low or negative d 18 O values were obtained for whole rocks and mineral-separates, decreasing towards the contact, with the intrusion itself retaining fairly high values. This trend has been attributed to the advection of meteoric water during magma emplacement, with increasing fluid/rock ratios (higher dyke intensities towards the intrusion acting as fluid-pathways) and higher temperatures promoting increasing exchange during recrystallisation.

A comparison of whole rock and mineral major- and trace- element data allowed the redistribution of elements between different mineral phases and generations, during contact metamorphism and partial melting to be assessed. Certain trace-elements, e.g. Zr, Hf, Y, and REEs, were internally redistributed during contact metamorphic recrystallisation, causing the enrichment of neocrystallised diopsides compared to relict phenocrysts. This has been assigned to the liberation of trace elements on the breakdown of primary minerals, kaersutite and sphene, on entering the thermal aureole. Major and trace element compositions of minerals in migmatite melanosomes and leucosomes are almost identical, pointing to a syn- or post-solidus reequilibration on cooling of the migmatite terrain.

The mineralogical, textural and geochemical evolution of dykes in a contact metamorphic aureole, is recorded around an apophysis of the PX1 intrusion, where there is evidence of incipient partial melting. Hydrothermal mineral pseudomorphs in the outer parts of the aureole are progressively replaced by dry mineral assemblages, with increasingly recrystallised diopside and evidence of partial melting - the extent of which varies from one lithology to another. The appearance of more mafic lithologies towards the intrusion, with lower whole rock SiO 2 and mobile element abundances, e.g. Rb, Cs, K, has been explained by the migration and accumulation of feldspathic material into leucosomes outside the samples.

A micro-structural study of leucosomes and leucocratic pods, with the aid of high-resolution X-ray computed micro-tomography (HRXµCT), allowing the visualization and quantification of shapes and orientations, was carried out in order to better

understand the processes of melt segregation in the PX1 aureole. Leucocratic pods, representing former amygdales, are considered as natural strain ellipsoids. Their short axes are oriented perpendicular to leucosome planes, which sub-parallel the intrusive contact. Leucosomes thus effectively represent foliation planes. This implies that the direction of maximum shortening, during migmatisation, was perpendicular to the orientation of leucosomes, contradicting earlier models that suggest leucosomes represent tension veins.