

Plagioclase crystal size distribution of tholeiitic mafic dikes in Rio de Janeiro, Brazil

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Crystal Size Distribution (CSD) of plagioclase in mafic dikes of the Buzios-Cabo Frio swarm (RJ, Brazil) were used to estimate their emplacement processes and magmatic residence times. At contact with the metamorphic basement the texture of the vertical dikes is fine-grained, and microporphyritic to intergranular at the center of the larger bodies. Samples were collected at the margins and at the center of the dikes. The plagioclase average characteristic size (C) varies from 0.07 and 0.13 mm at the margins of the narrow (< 1 m) dikes and from 0.09 to 0.20 mm at the margins of the larger (≤ 8 m) dikes. At the center of the dikes C varies from 0.17 to 0.7 mm. The CSDs near the chilled margins are concave-up. At the center of the larger dikes the CSDs is log-linear, consistent with a simple steady-state crystallization pattern. Plagioclase phenocrysts have a high An content (bytonite-labradorite) than the groundmass grains (labradorite-andesine). At the margins olivine is richer in Fo than at the center, and respectively, pyroxene is richer in Ca. These results indicate that the chilled margin is more mafic than the center suggesting a normal chemical trend in a cooling magma. The concave-up CSDs probably depict heterogeneous crystallization rates possibly induced by depressurization during magma ascent followed by rapid cooling. The log-linear CSD at the center of some larger dikes is attributed to a high residence time of the magma which favors the process of chemical diffusion and textural re-equilibration. Assuming constant and typical plagioclase growth rates, we calculate that the center of a dike with 8m in width would be completely crystallized (at c. 900 °C) in about 2 years.