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Strain partitioning into dry and wet zones and the formation of Ca-rich myrmekite in syntectonic syenites: a case for melt-assisted dissolution-replacement creep under granulite facies conditions

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Abstract

The formation of Ca-rich myrmekites is described in syntectonic syenites crystallized and progressively deformed under granulite facies conditions. The syenites are found in high- and low-strain zones where microstructure and mineral composition are compared. Heterogeneously distributed water-rich, late-magmatic liquids were responsible for strain partitioning into dry and wet high-strain zones at outcrop scale, where contrasting deformation mechanisms are reported. In dry high-strain zones K-feldspar and clinopyroxene are recrystallized under high-T conditions. In wet high-strain zones, the de-stabilization of clinopyroxene and pervasive replacement of relatively undeformed K-feldspar porphyroclasts by myrmekite and subordinate micrographic intergrowths indicate dissolution-replacement creep as the main deformation mechanism. The reworking of these intergrowths is observed and is considered to contribute significantly to the development of the mylonitic foliation and banding. A model is proposed for strain partitioning relating a positive feedback between myrmekite-forming reaction, continuous inflow of late-magmatic liquids and dissolution-replacement creep in the wet zone at the expenses of original mineralogy preserved in the dry zones. Melt-assisted dissolution-replacement creep in syntectonic environments under granulite-facies conditions may extend the field of operation of dissolution-replacement creep, changing significantly the rheology of the lower continental crust.

Keywords: syntectonic magmatism; syntectonic syenites; myrmekite; dissolution-replacement creep; strain partitioning; granulite facies conditions

1. Introduction

Myrmekite is one of the most commonly described and discussed microscopic feature in geology. This is ipartly due to its common ocurrence in a diversity of rocks and environments, and also because of the controversy generated since the early debate between the two proposed models for its genesis by replacement (Becke, 1908) and exsolution (Schwantke, 1909). With the advances in both science and technology, mainly with the advent of the scanning-electron microscope and microprobe, detailed observations of composition and