



Peraluminous two mica leucogranite of the Aderba Pluton, NE Golpayegan, Iran: Hydrogen isotope and chemistry of biotite significance

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With 6 figures and 2 tables

Abstract: The Aderba leucogranite forms a part of the Golpayegan metamorphic complex in the Sanandaj-Sirjan Zone and is mainly composed of quartz, alkali-feldspar, plagioclase and biotite (as the dominant ferromagnesian mineral), with subordinate amounts of muscovite, zircon, chlorite and sericite. The investigated Fe and Al biotites of the leucogranite have peraluminous character. Magma redox conditions based on the biotite composition place the Aderba leucogranite within the ilmenite series granitic rocks and reduced S-type granitoids, which is derived from a peraluminous magma via anatexis of metasedimentary rocks during a syn-collisional event. Biotite hydrogen isotope compositions have δD values ranging from -66‰ to -77‰ that are similar to those of the igneous biotites. The δD values indicate a high temperature deformation of the Aderba leucogranite pluton with no influence of an external (meteoric) fluid. Furthermore, the average δD value of the Aderba leucogranite (-64.4‰) demonstrates its S-type affinity.

Key words: biotite, hydrogen isotope, leucogranite, ilmenite series granitic rocks, Sanandaj-Sirjan Zone, Iran.

Introduction

Biotite is a significant ferromagnesian mineral in most intermediate and felsic igneous rocks. The composition of biotite largely depends on the nature of the magma from which it crystallized (ABDEL-RAHMAN 1994; SHABANI & LALONDE 2003; SHEIBI et al. 2010). Igneous biotite can be used to provide valuable petrogenetic information such as tectonic setting, magma type and the peraluminosity of the host magma (SPEER 1984; ABDEL-RAHMAN 1994).

Isotope compositions (e.g. $\delta^{18}\text{O}$ and δD) provide valuable information about granitic rocks and their values vary depending on the genesis of the granite rocks (ANDERSSON 2012). Also, stable isotope analysis of the constituent minerals can define pre- and post-metamorphic

hydrothermal alterations of meta-igneous rocks (ZHENG et al. 2003). For example, the low δD values (i.e. -109‰ to -89‰) of the biotites from gneisses in central Dabie, China argue for involvement of meteoric water during some stage of mica formation (ZHENG et al. 2003).

The main objective of the present work is to study the mineral chemistry and hydrogen isotope of the biotites from the Aderba leucogranite. Furthermore, the nature of the leucogranitic magma, and geotectonic environment of the investigated pluton as well as the oxidation state and water-rock interaction during cooling process of the concerned magma are delineated.

The Aderba granitic rocks are exposed in the Golpayegan Metamorphic Complex (GMC), north of Varzaneh, in the Sanandaj-Sirjan Zone of Iran (BERBERIAN & KING 1981; ALAVI 1994). The granitic rocks of the