

## Determining the physical crystallization condition of Lakhshak granodiorite pluton and its dykes

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(Received: 5/6/2016, in revised form: 28/9/2016)

**Abstract:** The Lakhshak pluton, a part of Zahedan-Saravan granitoid belt, is located about 15 km NW of the Zahedan city. The plutonic rocks are granodiorite in composition and are cut by a numerous of microdiorite and dacite dykes. The rocks of Lakhshak pluton consist of plagioclase (oligoclase-andesine), K-feldspar, quartz, biotite, amphibole (pargasite - edenite), sphene, apatite and opaque minerals. In this research, the composition of these minerals have been considered as the geo-thermometer and geo-barometer, hence they have good potential for calculating crystallization and emplacement conditions of a magma and tectonic setting. The presence of calcic amphiboles and primary biotite are evidence of Lakhshak pluton igneous origin (I). The amount of  $Al_{tot}$  in the pluton amphiboles are 1.02 to 1.32 representing the pluton emplacement at the depth of 3.8 to 8.4 Km; while the core of those amphiboles analyzed from dikes contain  $Al_{tot} = 1.9-2.3$  showing the depth of magma chamber in middle-lower crust (16.9-23 Km) as these dykes are thin and cooled fast after emplacement. The thermometry done on Lakhshak pluton and its dykes indicated cessation of exchange and equilibrium of minerals temperatures 645-732°C for pluton, 730-824°C for dacite dikes and for andesitic dikes are 808-945°C. Moreover, biotites were plot in calc-alkaline field of Abdul Rahmans diagram, which represents the Lakhshak pluton might be formed in an active continental margin during the subduction of Sistan oceanic lithosphere beneath Afghan Block.

**Keywords:** *thermobarometry; mineral chemistry; granodiorite; Lakhshak; Zahedan.*

متن فارسی اصل مقاله از صفحه ۳۱۱ تا ۳۲۸ در این شماره به چاپ رسیده است.

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