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Granulite Facies Metamorphism in the Kabul Block, Afghanistan

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The Proterozoic Kabul Block is part of the Afghan Central Massif and occurs between the Hindu Kush and Sulaiman Mountain ranges. It consists of amphibolite to granulite facies rocks of Paleo-Neoproterzoic age. The Kabul block has a lens-like shape and is encircled by the Chaman fault from NW and the Altimoor faults from SE. The basement rocks of the Kabul Block are predominantly represented by schists, gneisses and migmatites with lenses of amphibolites and locally also marble. They are mostly unconformably overlain by low-grade early to late Paleozoic sequences. As the Kabul block occurs between the magmatic arc and accretionary wedge which formed during subduction and subsequent collision of the Indian Plate beneath the Laurasian continent, it was subjected to compression and a metamorphic overprint during Alpine orogeny to various degrees.

The granulite facies rocks are exposed only locally within amphibolite facies gneisses and migmatites, exposed in the hills that surround Kabul city. They are represented by quartz-feldspathic lithology, which contains lenses of marble and amphibolite. Granulite facies conditions are confirmed by the presence of orthopyroxene both in the gneiss and amphibolite. In addition to orthopyroxene (XMg = 0.4, $Al2O_3$ = 1.3 wt %), the gneiss contains quartz, plagioclase (An27-36), orthoclase and biotite with XMg = 0.36 and TiO_2 = 3.5 wt %. The rocks are overprinted by amphibolite facies metamorphism, which is represented by the formation of garnet overgrowing biotite and orthopyroxene. The mafic rocks consist of plagioclase (An87), hornblende (XMg = 0.81), biotite and orthopyroxene (XMg = 0.57, $Al2O_3$ = 1.1 wt %) with inclusions of ilmenite, cummingtonite (XMg = 0.6) and biotite. Hornblende forms as a rim around cummingtonite and overgrows orthopyroxene. Biotite present in this sample has XMg = 0.63 with almost 4 wt % TiO_2. Marble adjacent to the granulites are mostly pure calcite, but at contact with surrounding rocks may contain also dolomite, phlogopite (XMg = 0.98) and pargasite (XMg = 0.95). SHRIMP dating indicated a Paleoproterozoic age for clastic zircons in the granulites and in the surrounding gneisses. In granulites some zircons shows thin rims, which yield a Mesoproterozoic age that can be interpreted to date the granulite facies event. Based on geological relations, the amphibolite facies metamorphism in the Kabul block seems to be of Neoproterozoic age, however the effect of Alpine metamorphism on the basement rocks is unclear. The research is aimed to estimate PT conditions of the granulite facies metamorphism and to clarify the relationship of the amphibolite facies overprint with respect to the surrounding rocks.