

## The Origin of the Nangarhar Talc Deposits in the Spin-Ghar Block, Afghanistan

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Talc deposits in the E-W trending Spin-ghar block, southeastern part of Afghanistan, were formed in Paleoproterozoic carbonate rocks. There are two types of talc mineralization in the study area, one in the western part (Dar, Kherwas and Janinaw deposits) and other in the eastern part (Mamond Dara deposits) of the block, hosted by magnesite and dolomite marbles, respectively. The objective of this study is to describe the talc mineralization on the basis of field observations, microscopic observation, XRD, XRF, ICP-MS and SEM-EDS analyses.

In the western part of the block, talc is parallel to sub parallel to magnesite rock and cross cut by intrusive igneous rocks of diabase. Metamorphic rocks of quartz chlorite schist are parallel to sub parallel to talc ore body and magnesite. Massive layers of tremolite about one meter thick were observed at Kherwas. Intrusive rocks have not been identified and a thin layer of talcose quartz has been marked within talc veins at Janinaw. A thick layer of talc contains needle like macroscopic tremolite crystals in the matrix of talc at Janinaw. In the Mamond Dara area at the most eastern part of the block, parallel alternating layers of talc and dolomite marbles occur with quartz chlorite schist mostly altered to chlorite. Massive gneiss occurs at the contact of these talc, dolomite marbles and quartz chlorite schist. Mineral assemblages in the western part are (a) talc + tremolite + calcite, and (b) talc ± cordierite, while those in the eastern deposits are (c) talc + dolomite + calcite ± quartz ± apatite and (d) talc + dolomite + calcite. Talc was formed by alteration of tremolite and magnesite in Dar and Kherwas deposits, while in Janinaw and Mamond Dara, talc was formed by alteration of dolomite and tremolite and by alteration of dolomite, respectively. Total REE contents of talc bodies, magnesite and dolomite marbles range from 0.9, 5.3 and 13.0 ppm, respectively. The SiO<sub>2</sub> contents of carbonates and talc bodies range from 1.6 to 33.3 wt% and from 52.9 to 65.1wt %, respectively, while MgO contents of carbonate and talc bodies range from 18.4 to 48.1 wt% and from 29.4 to 34.0 wt%, respectively. The CaO contents in talc bodies and magnesite are less than 1 wt%, while those of dolomite marbles ranges from 18.0 to 26.0 wt%. The concentration of Al, Ta, Hf, Zr, Th and REE in talc ore and carbonates rocks is very low and inconsistent with a felsic igneous rock protolith, whereas the low concentrations of Cr, Ni, and Co are inconsistent with a mafic igneous protolith. On the basis of this low concentration of trace elements and REE, the Mg-rich carbonate rock is likely the protoliths of talc ore. Magnesium has been derived from pre-existing Mg-rich carbonate host rocks, i.e., magnesite and dolomite marbles.

Keywords: Nangarhar, Spin-Ghar, Talc, Magnesite, Tremolite, Dolomite marble