

## Petrography and mineralogy of skarns in Garbodar, Iranshar, SE Iran

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Garbodar skarn is located in 10 km east of Bazman village and southeast of Bazman Quaternary volcano. The area is geologically a part of SE-trending Sahand-Bazman magmatic arc zone which formed by the subduction of NeoTethyan oceanic plate and collision of the Arabian plate beneath Central Iran. Geology of the Garbodar is mainly consist of Carbo-Permian sedimentary rocks which intruded by eastern part of Bazman Cretaceous granitoid. The granitoid is a multiphase zoned granitoid consists of granite, granodiorite, quartzmonzonite and minor diorite, gabbro followed by pegmatitic and aplitic dykes and veins. The granitoid is mainly equigranular in texture and contains plagioclase, K-feldspar, quartz, biotite and hornblende and minor titanite, magnetite, apatite and zircon. The Bazman granitoid is an oxidized I-type, metaluminous granitoid belongs to calc-alkaline magmatic series which evolved in an arc-continental tectonic setting. In the Garbodar, metamorphism and metasomatism of the Carbo-Permian sedimentary rocks in contact aureole of Bazman granitoid produced skarn assemblages and Cu mineralization. The skarns occur as a distinct zone between the marble and granitoid rocks. The skarn zone is a thin zone (up to 100 meters) relative to thick marble layers. The granitic rocks which are in contact with the metasomatized sedimentary rocks show partial argillic, propylitic and sericitic alteration. The skarn zone can be subdivided into endoskarn and exoskarn subzones. The endoskarn subzone was locally formed as irregular pods and veins into the granitic rocks near to the contact. The exoskarn subzone was extensively formed into the marble and can be divided into calcic skarn and magnesian skarn types. Following zonation is observed from the granitoid margin toward the marble layers: irregular endoskarn zone, thick garnet skarn zone (100 meters), clinopyroxene skarn zone (20 meters), pure marble layers (more than 200 meters) and biotite hornfels (very thick). The magnesian skarn occurs as irregular pods and lenses and is characterized by olivine and serpentine. The garnet skarn contains andradite-grossular solid solution series, epidote, calcite and quartz veins. The clinopyroxene skarn is characterized by diopside-hedenbergite, pistacite-clinozoisite, and tremolite-actinolite solid solution series and considerable calcite and quartz veins. Cu mineralization occurs as Cu-carbonate, Cu silicate and Cu phosphate veins. Although, sulfide minerals are rarely observed on the outcrops but abundant colored glassy smelting relics near to the mineralized area may be indication of sulfide Cu-bearing minerals. The contact aureole in the Garbodar was evolved in two main stages of metamorphic and metasomatic. The marble and hornfels were formed by heat of the granitoid during a contact metamorphic stage. The metasomatic stage can be divided into two substage of prograde and retrograde. Anhydrous minerals of garnet, clinopyroxene and forsterite and magnetite were formed during the prograde stage and hydrous minerals of amphiboles, biotite, epidote, serpentine and chlorite, calcite and quartz veins and sulfide minerals were formed during retrograde stage. Cu-carbonate, Cu-silicate and Cu-phosphate veins were formed during a supergene stage.

Keywords: Garbodar skarn, Bazman granitoid, Sistan and Baluchestan, SE Iran