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Fluid Inclusion Petrography and Microthermometry of Barren/Mineralized Quartz Veins-Reef of Malanjkhand Cu Deposit, Central India: Implication on Ore and Non-Ore Forming Environment

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Abstract

Quartz reefs and veins of variable thickness have been intruded in host Paleoproterozoic Malanjkhand granites in the mine area and are primarily restricted to phyllic as well as potassic alteration zones. They are mainly of two types: mineralized and barren. Fluid inclusion petrography depicts mainly five types of inclusion which are aqueous biphase, monophase, monocarbonic, H_2O-CO_2 and polyphase (L+V+H). They are called here Type I, Type II, Type III, Type IV, and Type V, respectively, and are present in both mineralized and barren quartz veins/reefs. All types of inclusion are common except type V, which appears rare in both. However, the sizes of type II and IV are unexpectedly small. The micro thermometry results imply a relatively high temperature (209.4-376.4°C) of fluid entrapment in the mineralized counterpart. However, it is considerably lower (133.9-182.2°C) for the barren counterpart. Although the salinity of fluid appears low for mineralized quartz veins/reef (0.63-0.87 wt.% NaCl equivalent), while for barren counterpart, it is considerably higher (0.92-0.98 wt.% NaCl equivalent). The observed textural and microthermometry results advocate that the Malanjkhand hydrothermal system has resemblances with the porphyry system and indicates probable genetic linkage between barren and mineralized quartz veins/reef.

Keywords: Fluid Inclusions, Quartz Veins/Reef, Aqueous Inclusions

Introduction

Fluid inclusion studies in hydrothermal ore deposits have recognized to be an important instrument for obliging the physico-chemical conditions of the hydrothermal fluids responsible for vast and pervasive alteration and mineralization processes (Bean and Titley, 1984; Roedder, 1984; Bodnar *et al.*, 2014). The fluid-inclusion physiognomies, such as fluid composition, temperature, and density, vary in different types of ore deposits. Because of the variation in these parameters, fluid inclusions are considered a useful tool for mineral exploration (Haynes and Kesler, 1987; Noronha *et al.*, 1992). Fluid evolution and ore mineral precipitation in hydrothermal systems are recorded by multiple generations of fluid inclusion assemblages and mineral inclusions, and their trapping sequence can be established through careful thin-section petrography (Klemm *et al.*, 2008; Seo *et al.*, 2009).

Due to their economic significance, Malanjkhand Cu deposits have been intensely investigated and much is known about the host-granite forming environment, age, andtectonism (Sarkar *et al.*, 1996; Panigrahi and Mookherjee, 1997; Sikka and Nehru, 1997; Stein *et al.*, 2004; Asthana *et al.*, 2016). However, the fluid inclusion studies of mineralized and barren quartz veins and reefs are relatively less and produce variable results (Jaireth and Sharma, 1986; Panigrahi *et al.*, 2008). Moreover, it is still a major debate whether the Malanjkhand Cu deposit is a porphyry deposit or not. The present work is focused on the fluid inclusion study of mineralized and barren quartz veins and reef in order to find the nature of fluid, temperature of fluid entrapment and to established the genetic link between barren and mineralized quartz reef. Attempts have also been made to test its very porphyry nature.

Geology of the Area

Malanjkhand is associated with three different lithological terranes: the Sausar Mobile Belt (SMB) to the northwest, which forms the southern part of the Central India Tectonic Zone (CITZ); the Sakoli Fold belt (SF) to the southwest; the Kotri-Dongargarh (KD) belt to the south. The Sausar Mobile Belt (SMB) lies to the northwest part of Malanjkhand and marks the northern part of CIS (Fig. 1a). The southernmost unit in the SMB is the Bhandara-Balaghat granulite domain bounded by the CIS to the south. The Ramakona-Katangi granulite belt lies to the northwest of CIS (Stein

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