

Physio-Thermal and Geochemical Behavior and Alteration of the Au Pathfinder Gangue Hydrothermal Quartz at the Kubi Gold Ore Deposits

Authors : Gabriel K. Nzulu, Lina Rostorm, Hans Högberg, Jun Liu, per Eklund, Lars Hultman, Martin Magnuson

Abstract : Altered and gangue quartz in hydrothermal veins from the Kubi Gold deposit in Dunkwa on Offin in the central region of Ghana are investigated for possible Au associated pathfinder minerals and to provide understanding and increase the knowledge of the mineral hosting and alteration processes in quartz. X-ray diffraction, air annealing furnace, differential scanning calorimetry, energy dispersive X-ray spectroscopy, and transmission electron microscopy have been applied on different quartz types outcropping from surface and bed rocks at the Kubi Gold Mining to reveal the material properties at different temperatures. From the diffraction results of the fresh and annealed quartz samples, we find that the samples contain pathfinder and the impurity minerals FeS₂, biotite, TiO₂, and magnetite. These minerals, under oxidation process between 574-1400 °C temperatures experienced hematite alterations and a transformation from α -quartz to β -quartz and further to cristobalite as observed from the calorimetry scans for hydrothermally exposed materials. The energy dispersive spectroscopy revealed elemental species of Fe, S, Mg, K, Al, Ti, Na, Si, O, and Ca contained in the samples and these are attributed to the impurity phase minerals observed in the diffraction. The findings also suggest that during the hydrothermal flow regime, impurity minerals and metals can be trapped by voids and faults. Under favorable temperature conditions the trapped minerals can be altered to change color at different depositional stages by oxidation and reduction processes leading to hematite alteration which is a useful pathfinder in mineral exploration.

Keywords : quartz, hydrothermal, minerals, hematite, x-ray diffraction, crystal-structure, defects

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