6th Intern. Conf. On Geochemistry, Alex. Univ., Egypt, 15-16 Sept. 2004, Pages 143-160

GENESIS OF GOLD MINERALIZATION AT ZALM MINE, CENTRAL SAUDI ARABIA

Harbi, H.M.
Department of Mineral Resources and Rocks, Faculty of Earth Sciences,
King Abdulaziz University, Jeddah, Saudi Arabia

ABSTRACT: Gold mineralization in the Zalm area extends for about 1 km with variable thickness and is confined to a NE-trending fracture zone, which is considered as a second-order fault and extensional fissures, associated with NW-trending strike-slip Najd fault system. The mineralization is present in the form of stockwork of quartz veins (few centimeters thick) and veinlets (few millimeters thick), and is hosted by monzogabbro (MG), monzonite (M), quartz monzonite (QM), and alkali pyroxene granite (G). The wall rock alterations include sercitization, chloritization, carbonitization, silicification and sulfidation. Usually the quartz veins are surrounded by a bleached zone separating it from the wall rock. Generally, the veins are poorly mineralized and ore minerals are represented mainly by pyrite and arsenopyrite, minor galena, sphalerite, chalcopyrite and traces of sulfosalts. Gold is present as electrum or as gold tellurides associated with pyrite and arsenopyrite. Fluid inclusion studies led to the recognition of three types: H_2O-CO_2-NaCl (Type 1); H_2O±CO_2-NaCl (Type 2); and H_2O-NaCl (Type 3). The majority of Th_{tot} of type 1 inclusions fall between 260 – 340 °C and the salinity ranges between 2 and 4.8 wt% NaCl equivl. Type 2 inclusions are characterized by their lower volume proportions of vapour, lower Th_{tot} (170 to 255 °C) and salinity of 2.5 to 5 wt% NaCl equiv. The aqueous H_2O-NaCl inclusions have Th_{tot} within the range of 70-120°C and they are of lower salinity (1 to 5 wt% NaCl equiv). Generally, the moderate to low temperatures and low salinities of the fluid inclusions favour a meteoric origin of the mineralizing fluids. Fluid inclusion studies as well as petrographic criteria and the trace elements (Cu, Pb, Zn, and As) contents of the host rocks (MG, M, QM, and G) indicate that they could be the source of the metallic elements which were leached and remobilized by the percolating meteoric water.

INTRODUCTION

The Arabian shield represents the exposed Precambrian basement of the Arabian Plate. It is exposed in the western part of the Saudi Arabia and in the adjacent parts of Yemen and Jordan (Johnson, 2000). The Precambrian rocks in the shield vary from Paleoproterozoic crust in the eastern terranes to juvenile Neoproterozoic rocks in the western terranes. According to Camp (1984) and Stoeser and Camp (1985), the Arabian Shield is composed of five discrete tectono-stratigraphic terranes (microplates), separated by four ophiolite-decorated suture zones (Fig. 1).

The western terranes (Asir, Hijaz and Midyan) are composed of volcano-sedimentary sequences formed by repetitive magmatism in ensimatic island arc environments since 950 Ma (Camp 1984; Stoeser and Camp 1985; Stoeser and Stacey 1988). These terranes were accreted between about 780 to 680 Ma along east- to northeast-trending Bi'r Umq and Yanbu suture zones. The eastern terranes (Afif and Ar