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Hydrothermal alteration and gold mineralization of the meta-sedimentary rock hosted gold deposit Awak Mas, Sulawesi Island, Indonesia

Harjanto, E. [1,2], Meyer, F.M.[1] and Idrus, A.[3]

[1]IML, RWTH Aachen Germany. Wüllnerstraße 2 Aachen. ernowo.ernowo@rwth-aachen.de
[2]Geological Agency of Indonesia, Soekarno-Hatta Street 444, Bandung, Indonesia
[3]Gadjah Mada University, Indonesia. Grafika Street 2, Yogyakarta, Indonesia

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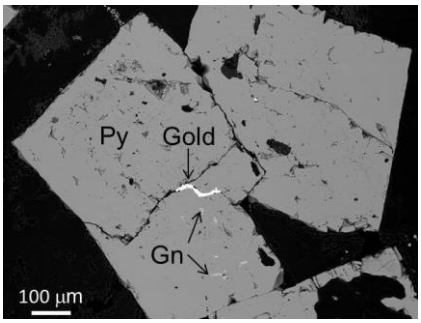
Sulawesi Island situated in the centre of the Indonesian archipelago has a complex geological setting comprising magmatic arcs, metamorphic and ophiolite belts that resulted from the interaction of continental and oceanic plates. For many decades, gold exploration in the area was focused on magmatic arc-related volcanic rock-hosted hydrothermal deposits as well porphyry- and skarn-type mineralization. However, recent gold exploration activities also include metamorphic terrains. As a result, numerous gold deposits were discovered hosted by metamorphic rocks in Sulawesi Island such as Bombana, Poboya, Bastem and Awak Mas.

Awak Mas is a metasedimentary-hosted gold deposit in the Cretaceous Latimojong formation member that forms part of the Sulawesi metamorphic belt. Host rocks consist of slates, phyllites, basic to intermediate volcanics, limestones, and schists, representing a platform and/or fore arc trough-flysch sequence, locally intruded by diorite dykes. Tectonically, the area is transected by NNE-SSW trending, parallel to sub-parallel and sub-vertical fault zones [1].

The host rocks to the mineralized zone comprise schists and phyllites that were subjected to low-grade greenschist facies metamorphism. The mineralogy is predominantly quartz, muscovite, dolomite, sericite, kaolinite, chlorite and graphite with varying grain size and abundance. Pervasive hydrothermal alteration overprint resulted in kaolinitization, silicification, carbonatization, carbonization, albitization, and sulfidation. Quartz and carbonate also occur in form of continuous and discontinuous veins and/or veinlets. Banded graphite that occurs in the proximal zone is one of diagnostic alteration minerals associated with the metamorphic-related hydrothermal system.

The two main styles of mineralization are quartz veins and hydraulic breccias. Sulfide mineralization is mainly present in the albite-quartz-carbonate altered phyllite and schist. Euhedral pyrite is the most abundant sulfide and occurs disseminated in the albite-quartz-carbonate alteration zone with grain sizes up to 1 mm. Sphalerite, galena and chalcopyrite commonly form inclusions in pyrite.



Micron-size gold grains were detected within pyrite and between pyrite crystal boundaries (Fig.1). Assay data of drill core samples indicate gold grades in mineralized phyllites and schists ranging from 0.02 to 0.54 ppm, and from 0.2 to 3.8 ppm, respectively. Elevated Au values are generally found in the hydraulic brecciated schist. There is no clear relationship between gold and base metal content, however samples with high gold values tend to contain low copper, lead and zinc.

Figure 1: Backscatter electron-microprobe image of a gold-filled fracture in pyrite.

Calculated oxygen isotope analysis of quartz veins yielded ^{TM18}O values ranging between 17.9 ‰ and 20.6 ‰ suggesting that hydrothermal fluids originate predominantly sourced from metamorphic dewatering reactions [2]. Thus, the characteristics of the Awak Mas gold deposit are consistent with that of orogenic gold deposits.

Reference :

[1] Querubin and Walters (2012) Majalah Geologi Indonesia 27 : 69-85
[2] Hoefs J (2009) In : *Stable Isotope Geochemistry* : Springer, 123-136