



Geology, mineralization, geochemistry and petrology of intrusions in the Kuh Zar Au-Cu deposit, Damghan

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Submitted: May 9, 2017

Accepted: Oct. 3, 2017

Keywords: Subvolcanic rocks, Geochemistry, Au-Cu Porphyry, Kuh Zar, Torud-Chah Shirin

Introduction

Kuh Zar Au-Cu deposit is located in the central part of the Torud-Chah Shirin Volcanic-Plutonic Belt, 100 km southeast of the city of Damghan. Mineralization including quartz-base metal veins are common throughout this Cenozoic volcano-plutonic belt (Liaghat et al., 2008; Mehrabi and Ghasemi Siani, 2010). The major part of the study area is covered with Cenozoic pyroclastic and volcanic rocks that are intruded by subvolcanic rocks. This paper aims to study the geological, geochemical and petrogenesis of the area using exploration keys for new mineral deposits in the Torud-Chah Shirin zone.

Materials and methods

To better understand the geological units and identify the alteration zones of the area, 200 rock samples were collected from the field and 132 thin sections with 15 polished thin sections were prepared for petrography and mineralization studies. Ten samples of intrusions with the least alteration were analyzed using the XRF at the East Amethyst Laboratory in Mashhad, Iran. These samples were also analyzed for trace and rare earth elements using ICP-MS, following a lithium metaborate/tetraborate fusion in the Acme Analytical Laboratories Ltd, Vancouver, Canada. 137 geochemistry samples were prepared by the chip composite method of alteration and mineralization zones and were analyzed in the Acme laboratory by Aqua Regia AQ250.

Results

The geology of the area consists of pyroclastic (crystal tuff) and volcanic rocks with andesite and latite composition, which were intruded by subvolcanic intrusive rocks with porphyritic texture and monzonitic composition. Monzonite rocks were intruded by younger subvolcanic units with dioritic composition. The intrusion of monzonitic pluton and stocks led to the formation of QSP, propylitic, carbonate and silicification-tourmaline broad alteration zones in the area. Monzonite rocks accompanied with disseminated mineralization of about 1 to 10% of pyrite and these sulfides have been converted to secondary iron oxides such as goethite, hematite and limonite. Lithochemical exploration revealed Au (up to 598 ppb), Ag (up to 3747 ppb), Cu (up to 679 ppm), Pb (up to 1427 ppm) and Zn (up to 1013 ppm) anomalies. Based on geochemical studies, intrusive rocks have characteristics of high-K Calc-alkaline to slightly shoshonitic and they are within metaluminous to the slightly peraluminous range. Enrichment of LREE versus HREE, enrichment of LILE and depletion in HFSE indicate that the magma was formed in the subduction zones. The negative Eu anomaly is due to the presence of plagioclase as a residual mineral in the magma source. The parent magma is probably formed by the partial melting of amphibolites. The presence of monzonite porphyry source rock, QSP and propylitic alterations, pyrite disseminated mineralization and geochemical anomalies of Au and Cu in the Kuh

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DOI: 10.22067/econg.v10i1.64316

Zar deposit represents Au-Cu porphyry mineralization in the area.

Discussion

Tectonic setting discrimination diagrams (Pearce et al., 1984) show that subvolcanic rocks plot almost on the fields of the volcanic arc granites (VAG). In the Rb/Zr vs. Nb diagram from (Brown et al., 1984), the samples are plotted in the field of primitive island arc/continental margin arc. The Torud-Chah Shirin Belt is a part of the Alborz magmatic assemblage (AMA). The AMA has been interpreted to represent the subduction of the Neo Tethyan oceanic lithosphere beneath the Central Iranian continental microplate and the subsequent continental collision of the Arabian and Iranian microplates in the late Cretaceous-early Cenozoic (Berberian and Berberian, 1981; Berberian et al., 1982; Alavi, 1994; Golonka, 2004).

Acknowledgement

This study has been supported by the Research Foundation of the Ferdowsi University of Mashhad, Iran (Project No. 27126.3). The authors would like to acknowledge the East Amethyst Laboratory for XRF analysis. We also thank the Gold Company of Iran for providing conditions for camping and accommodation.

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