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Araştırma / Research

GEDABEK (BATI AZERBAYCAN) Au-Cu YATAĞININ JEOLOJİK VE MİNERALOJİK ÖZELLİKLERİNE DAİR İLK BULGULAR

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ÖZET

Önemli petrol ve doğal gaz yataklarına sahip olan Azerbaycan'da aynı zamanda ekonomik altın, demir, bakır ve civa gibi pek çok metalik maden yatağı da yer almaktadır. Bu çalışmada Gence'nin (Batı Azerbaycan) 50 km batısındaki Şahdağ Sıradağları'nın kuzeybatı yamacında ve Gedebey'in kuzeybatısında bulunan en önemli altın bakır yataklarından biri olan Gedebey (Batı Azerbaycan) altın-bakır yatağının jeolojik ve mineralojik özelliklerinin araştırılması amaçlanmıştır. Gedebey altın-bakır yatağı, Pakistan'dan, İran, Azerbaycan, Gürcistan ve Türkiye'ye kadar uzanan, dünyanın önemli altın ve bakır provenslerinden biri olan Tetis Tektonik Kuşağı'nda bulunan ve bakır işlemeciliğinin antik alanlarından biri olarak bilinen Küçük Kafkaslar bölgesinin Azerbaycan bölümünde yer almaktadır. Başta Gedebey olmak üzere bölgede Alaverdi, Şamlık, Mishana, Zengezur ve Şenerdere bölgeleri gibi sayısız antik bakır madenlerinde bakır cevherlerinin yeniden işleme faaliyetleri sürdürülmektedir. Bölgede değişik yaş ve bileşimli magmatik kayaçlar ve kırılmalarla karmaşıklaşmış Orta ve Üst Jura tortulları yer almaktadır. Gedebey maden yatağının çevresi, özellikle Şemkir antiklinalinin tektonik yapısı nedeniyle çok karmaşık olup bölgede gerçekleşen magmatik faaliyetler de Bajosiyen (Orta Jura), Batoniyen (Orta Jura) ve Geç Jura-Erken Kretase olmak üzere üç aşamada meydana gelmiştir. Azerbaycan'ın en büyük porfiri-epithermal cevherleşme sahasında bulunan Gedabek Au-Cu yatağı, Orta Jura yaşlı andezitik kayaçlar ile onları kesen Üst Jura-Alt Kretase yaşlı granitoyid (granodiyorit-diyorit vs.) kontaktında buna bağlı gelişen quartz porphyry içerisinde meydana gelmiştir. Başlıca cevher minerallerini kalkopirit, sfalerit, kovellin, kalkozin, galenit, arsenopirit, galenit, bornit, kaolinit ve yaygın piritler oluşturmakta olup bunlarla birlikte barit, demir hidroksitler, nabit altın ve gümüş yaygın olarak görülmektedir.

Anahtar kelimeler: Altın, bakır, mineraloji, Azerbaycan, Gedabek

PRELIMINARY GEOLOGICAL AND MINERALOGICAL FEATURES OF GEDABEK (WESTERN AZERBAIJAN) Au-Cu DEPOSIT

ABSTRACT

In this study, it was aimed to investigate the geological and mineralogical properties of Gedabek (West Azerbaijan) gold-copper deposit, which is one of the most important gold copper deposits of Azerbaijan, in the northwest of Gedabek and 50 km west of Ganja (West Azerbaijan). Gedabek gold-copper deposit, extending from Pakistan, Iran, Azerbaijan, Georgia to Turkey, the world's major gold and one of the copper province Tethyan Tectonic Belt located and is known as one of the ancient areas of the copper engraving Lesser Caucasus in the Azerbaijan section of is located at. In the region, especially in Gedabek, numerous antique copper mines such as Alaverdi, Şamlık, Mishana, Zengezur and Şenerdere are undergoing re-processing for copper mining. Middle and

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Upper Jurassic sediments which are complicated by magmatic rocks and fractures of different ages and compositions in the region. Due to the tectonic structure of the Gedabek deposit and the tectonic structure of the Semkir anticline, the magmatic activity in the region has also occurred in three stages: Bajocian, Batonian and Late Jurassic. The Gedabek Au-Cu deposit, observed in the biggest porphyry-epithermal ore field of Azerbaijan, were occurred in the quartz porphyry which was formed in the contact of the Middle Jurassic andesitic rocks and the Upper Jurassic-Lower Cretaceous granitoid (granodiorite-diorite). The main ore minerals are chalcopyrite, sphalerite, galena, arsenopyrite, bornite, pyrite, covellite, chalcocite, native gold, silver, kaolinite, barite, and iron hydroxides.

Keywords: Gold, copper, mineralogy, Azerbaijan, Gedabek

1. INTRODUCTION

The Gedabek gold-copper deposit is located at the northwest slope of the Shahdag Mountain Range, 50 km west of the Ganja Province, north of the Nagorno-Karabakh Region of the Republic of Azerbaijan, and on the northwestern of Gedabek (Fig. 1). Gedabek gold-copper plant, which was started 2000 years ago and operated by the Ottoman, Iranian and Azerbaijani Khanates by changing hands periodically after the first settlers with rich copper occurrences, came to AIMC (Azerbaijan International Mining Company) after Azerbaijan gained its independence in 1991. After prospection and exploration studies of AIMC production started. In this production stage, an average of 60.000 ounces of gold was produced annually in the Gedabek gold-copper deposit.

The area around the Gedabek deposit is particularly complicated due to the tectonic structure of the Shemkir anticlinal and the magmatic activities in the area are also very complicated. The magmatic activity in this region has been realized in several stages and it has been stated that magmatism occurred in three different periods as Bajocian, Batonian (Middle Jurassic) and Upper Jurassic-Early Cretaceous in the studies related to magmatism of Gedabek region [1, 2]. The Gedebak Au-Cu deposit is commonly observed in the east, northeast and southeastern slopes of the Misdağ mountain. The Gedabek Au-Cu mineralization is located in the quartz porphyry occurring in the contact of andesitic rocks (Middle Jurassic) and granitoid (Upper Jurassic-Lower Cretaceous). Size of the gold enrichment area is approximately 1.3 square kilometers. Average exploitable Au, Ag and Cu contents of the ore samples are 1.1 g/t, 10.2 g/t and 0.27% respectively. According the size and element contents there are 16061,4 kg gold, 138547,5 kg silver and 7383 tones copper reserve in the Gedabek deposits.

Figure 1. The location map of Gedabek gold-copper deposit (modified from [3]).

2. MATERIAL and METHOD

In order to carry out fieldwork, an application was made to the Azerbaijan International Mining Company (AIMC) by the Department of Geological Engineering of the Engineering Faculty of Selçuk University (Konya Technical University). The company permit for the necessary works between May and August 2018. The materials required for fieldwork were covered by the company. Before the field studies, general information about the geology of the Gedabek gold-copper deposit and the magmatism in the locality was acquired. During the

fieldworks, samples from mineralization regions, ore-related wall rocks, alteration zones, stream sediments, gallery waste and soils were collected. Ore, hydrothermal alteration, wall rock, rust samples and soil samples are numbered separately and coordinates of all samples were noted.

After completing the fieldwork, samples were brought to Turkey, and the polished sections were prepared in Selçuk University SUKOP Gemstone Research and Application Centre. The thin sections were prepared in Pamukkale University to investigate the mineralogical and petrographical features. The all prepared sections were examined and take images by ore microscope at the Geological Engineering Department of Selçuk University (Konya Technical University).

3. RESULTS

3.1. Regional Geology

Gedabek magmatism is related general geological structure and tectonic position of the Lesser Caucasus and the rise of the Shamhor region with transtensional tectonics and the volcanism. The Gedabek mine region, which has a complicated geological structure, is located in the west of the Dashkesen synclinorium in the Lok-Aghdam region and axis of Shamkir anticlinorium in the Somhit-Aghdam region of the Lesser Caucasus. The various age and composition of magmatic rocks and fractures complicated with Middle and Upper Jurassic sediments are located in the Gedabek gold-copper deposit region (Fig. 2). The Gedabek gold-copper deposit were occurred in the quartz porphyry which was formed in the contact of the Middle Jurassic andesitic rocks and the Upper Jurassic-Lower Cretaceous granitoid (granodiorite-diorite).

The ore perspective areas (porphyry, high and low sulfidation epithermal deposit types) are embedded in cone-shaped Mountain Yogundag at elevation 2085 m and Gyzyldjadag at altitude 2250.6m [4]. The Gedabek Au-Cu deposit is one of the main producing mining of the Gedabek ore district of Azerbaijan. The Gedabek deposit is located in the largest porphyry-epithermal ore field of the country emplaced in the Lesser Caucasus located in the central part of the Tethys metallogenic belt. The Gedabek deposit is emplaced within the Jurassic-Cretaceous Lok-Karabakh magmatic arc, resulting from the subduction of the Tethys Ocean along the Eurasian margin [4,5]. The Gedabek ore-boundary fault starts from east of Gedabek deposit and continue through the North parts of Gadir, Umid, Mubariz and Zefer areas [6].

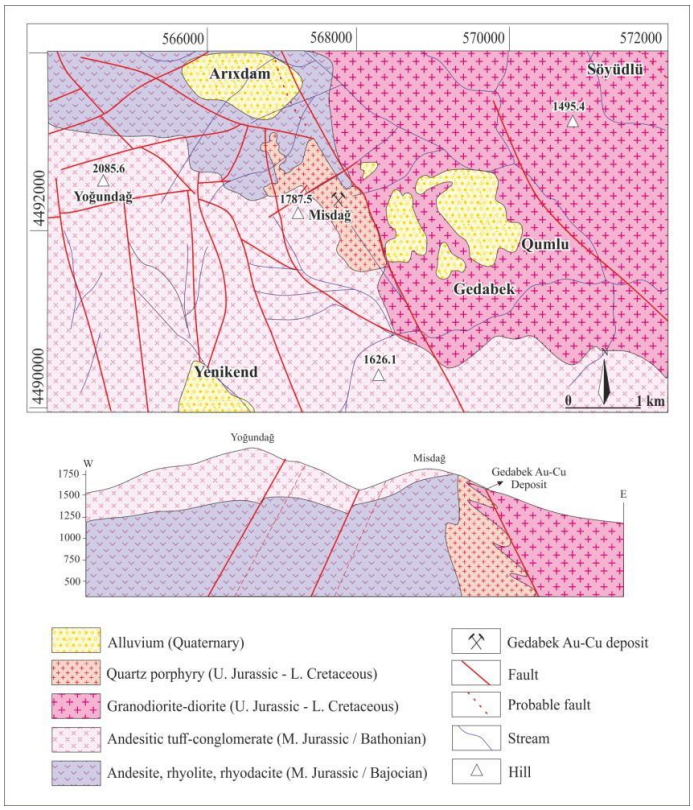

Figure 2. Geological map and cross section of the Gedabek Au-Cu deposit region (modified from [7]).

3.2. Mineralogy

In the petrography studies of the rock samples collected from Gedabek gold-copper deposit, plagioclase, orthoclase, biotite, amphibole, chlorite, opaque minerals in the diorite samples (Fig. 3a,b); plagioclase, muscovite, amphibole, pyroxene, epidote, calcite, sericite and opaque minerals were observed in the andesite samples.

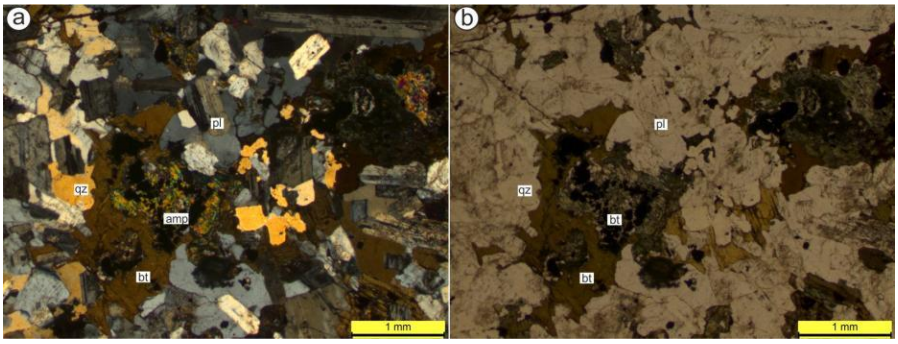

Figure 3. The diorite sample composed of plagioclase (pl), quartz (qz), amphibole (amp), and biotite (bt) from the Gedabek gold-copper deposit (a: +N, b: //N).

The hydrothermal alteration zones in the samples collected from the Gedabek Au-Cu deposit were distinguished as potassic, phyllic, argillic and propylitic alterations. In potassic alteration, K-feldispar, biotite, albite, pyrite were observed. Pyrite, quartz, sericite and chlorite were found in phyllic alteration zones (Fig. 4a); kaolinite, alunite, hematite, chlorite and pyrite minerals were found in the argillic alteration zones. In the propylitic alteration zones, epidote, chlorite, prophyllite, apatite, quartz, calcite and pyrite were determined (Fig. 4b).

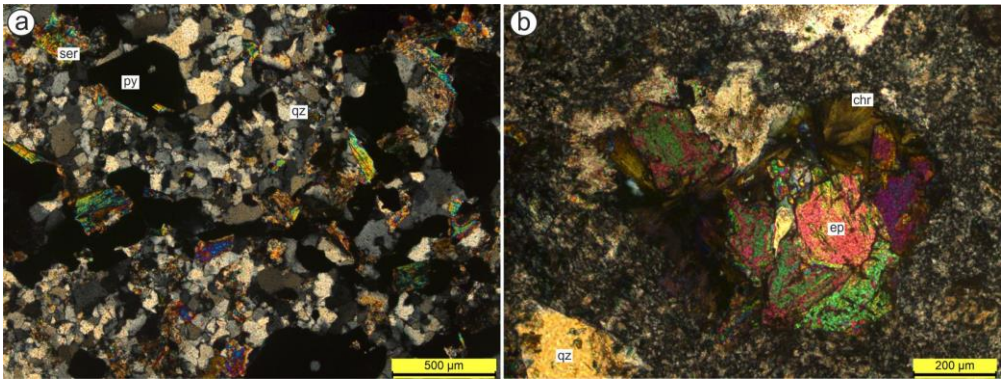

Figure 4. Belong to Gedabek gold-copper deposit, phyllic alteration consisting of sericite (ser), quartz (qz) and pyrite (py) minerals (a); prophylitic alteration consisting of epidote (ep), chlorite (chl) and quartz (qz) minerals (b), (a, b: + N).

The main ore minerals are chalcopyrite, sphalerite, galena, magnetite, fahlore, arsenopyrite, bornite, pyrite, limonite, malachite, azurite, covellite, chalcocite, hematite, goethite and specularite were determined in the samples collected from the Gedabek Au-Cu deposit (Fig. 5a,b, 6a-c).

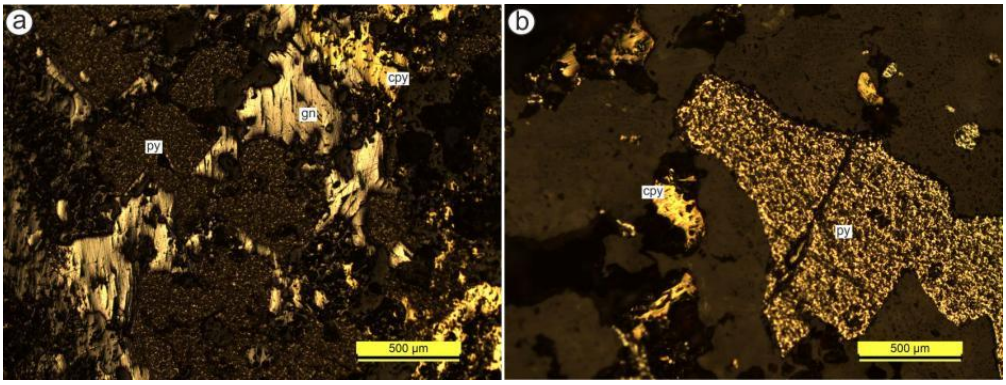

Figure 5 (a,b). Galena (gn), chalcopyrite (cpy) and pyrite (py) minerals in the ore samples from the Gedabek gold-copper deposit (//N).

Figure 6. (a) Cu mineralizations (malachite, azurite, covellite etc.) in the quartz porphyry from the Gedabek Au-Cu deposit, **(b)** chalopyrite and sphalerite **(c)** malachite and covellite in hand samples.

4. CONCLUSION

The Gedabek gold-copper deposit, one of the most important gold-copper deposit in the northwestern of Azerbaijan, is located in the Middle and Upper Jurassic sediments, which are complexed with magmatic rocks and fracture of different ages and fractures. The Gedabek gold-copper deposit, occurred in the porphyry-epithermal mineralization area, is hosted in the quartz porphyry which was formed in the contact of the Middle Jurassic andesitic rocks and the Upper Jurassic-Lower Cretaceous granitoid (granodiorite-diorite). The main ore minerals are chalcopyrite, sphalerite, covellite, chalcocite, galena, pyrrhotite, sericite, fahlore, arsenopyrite, copper, native gold, silver and common pyrites. The hydrothermal alteration zones of the Gedabek Au-Cu deposit were defined as potassic, phyllic, argillic and propylitic alterations. The current study is the preliminary findings of the study that started and continued in the Gedabek Au-Cu deposit.

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