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Geological and Geochemical characterization of the radiolarite hosted Mn mineralization in Taşdemir (Pazarcık, Kahramanmaraş, Turkey)

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Abstract

Along the Southeast Anatolian Orogenic Belt, units existing to the Arabian plate and series of Ophiolitic Melange overlain by tectonic contact are observed. In the Upper Cretaceous aged thrust belt, the Koçali Complex is situated at the base and the Karadut Complex is at the top, respectively. Throughout this belt, Mn mineralizations are identified in the lithologies of the Karadut Complex. Around Taşdemir Village (Pazarcık-Kahramanmaraş), units existing to the Koçali and Karadut Complex are frequently observed. Haydar and Germav formations overlie these units with angular unconformity. All units are covered with Middle-Upper Eocene aged limestones existing to the Midyat Group with angular unconformity consequently. In this district, Mn mineralizations linked with the radiolarites of the Karadut Complex are observed. Stratiform type Mn mineralization is observed in the form of lenses between the layers. Reddish brown and dark gray forms have been identified. Major oxide and trace element analyzes of samples gathered from the ore zone were carried out. As a result of the analysis, the MnO range was detected as 7.42-32.76% (average20.65) and the SiO2 range was detected as 60.68-83.52% (average72.88). Fe/Mn rate is considerably lower than 0.1 In order to highlight the origin of manganese mineralization, major and trace elements are evaluated in the diagrams. These evaluations indicate that the mineralization is of hydrothermal origin.

Introduction

In addition to being a strength-enhancing substance in the iron and steel industry, manganese is also widely used in battery technology in relation to the green energy growth in recent years. The need for manganese, which contains significant physical and chemical properties, is increasing day by day. For this reason, mineral deposit exploration is also widespread.

Mn deposits observed in many geological environments are classified corresponding to their geological, tectonic, mineralogical and geochemical properties. These are; (1) hydrogenous (2) hydrothermal and (3) diagenetic deposits respectively [1-3]. In these classifications, Fe/Mn contents also offer significant clues about the origin of the deposit [4]. Since manganese deposits in Turkey are related to the evolution of the Tethys Ocean, the deposits have been described in different geological environments [5-9]. The belts that stand out from these deposits are the İzmir Ankara Erzincan Suture Belt and the Southeastern Anatolian orogenic belt. These belts contain hydrothermal and hydrogenetic manganese deposits associated with radiolarian cherts [7, 9]. There are many manganese mineralizations in the Southeastern Anatolian Orogenic Belt, where the study area is located, in the literature [10-11].

Kahramanmaraş has attracted the attention of many geoscientists due to its geological features. Important geological structures are observed in the Kahramanmaraş region, which is an important area where the Taurus Orogenic Belt and the Arabian Plate are sutured. Because of this complex structure, Gül [12] defined these regions as the Orogenic belt and the Arabian plate belt and divided the units belonging to these two belts into sub-belts. Taşdemir (Pazarcık, Kahramanmaraş) manganese mineralization is orogenically located in two important tectonic units such as the Southeast Fold Belt and the Eastern Taurus Orogenic Belt. According to Gül [12], the study area is located in the margin fold belt at the northern end of the Arabian plate. Mn mineralizations are observed in the sedimentary rocks outcropping in the Taşdemir (Pazarcık) region. In this paper, the geological, mineralogical and geochemical characters of the mineralization are revealed.

Material and Method

Observational geological investigations were carried out in the ore zone. As a result of the observations, sampling was made in the ore zone in order to conduct mineralogical and geochemical studies. Major oxide and trace element analyzes of these samples were performed at ITU-JAL using XRF and ICP-MS methods. XRD analyzes were also performed for mineralogical identification.

Geological Background

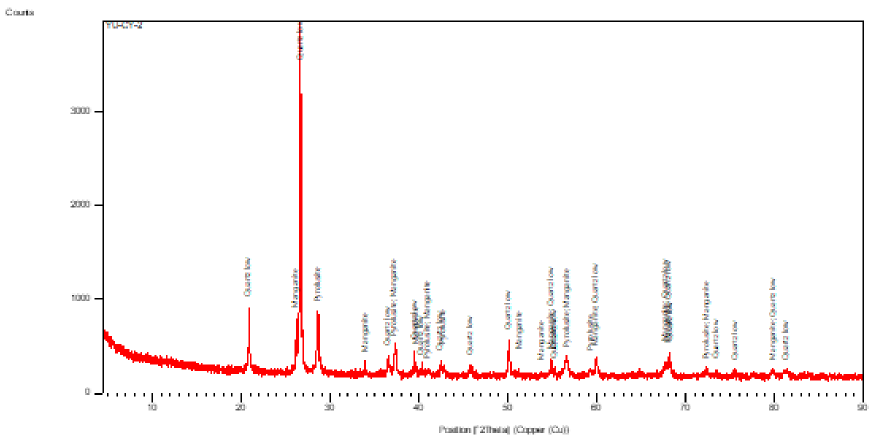
Around Taşdemir Village (Pazarcık-Kahramanmaraş), units belonging to the Koçali and Karadut Complexes are commonly observed. Haydar and Germav formations overlie these units with angular unconformity. All units are covered with Middle-Upper Eocene aged limestones belonging to the Midyat Group with angular unconformity. The contacts of the melange in the study area are generally tectonic. Thrust zones are cut by dip-slip faults in places and by strike-slip faults in places. In this region, Mn mineralizations associated with the radiolarites of the Karadut Complex are observed.

Ore geology

The mineralization consists of short and medium sized lenses in conformity with the layers (Figure 1a). It is commonly exposed at different levels of the layers of the succession. This formation continues along a zone of approximately 250 m. The ore lenses, which can be clearly identified in the field with their blackish color, have also been altered in places (Fig 1b).

XRD study was carried out for the mineralogical identification of the samples taken from this ore zone. As a result of the analysis, pyrolusite and manganite minerals were determined (Figure 2).

Figure 1. General view of ore zone



Ref. Code	Mineral Name	Chemical Formula
98-000-5737	Pyrolusite	Mn1 O2
98-003-9931	Manganite	H1 Mn1 O2

Figure 2. XRD diagram

Geochemistry

According to the analysis, the amount of SiO_2 is rather rich. The reason for this is the intense exposure of radiolarites. MnO values at ore levels are between 7.42-32.76%. When the other major oxide values are examined, there is no substantial anomaly. No alternative metallic enrichment is observed in samples with high manganese.

In the Si–Al discrimination diagram [13], the mineralization is distributed within the hydrothermal field due to low Al and high Si content. Likewise, in the triangular diagram [14], which is a different diagram, in which trace elements such as Co, Zn and Ni are compared relative to each other, they show distribution in the hydrothermal area.

Conclusion

One of the basic approaches for the identification of manganese deposits is the Fe/Mn ratio of the ore. In studies on manganese mineralization of various types [15-16], the Fe/Mn ratio of mineralization is 1 in hydrogenetic deposits that slowly precipitate from seawater. In the submarine hydrothermal deposits around the region, <0.1 (manganese-rich) and >10 (rich in iron) was determined. Very low Fe/Mn ratios are explained by the rapid precipitation of hydrothermal solutions in submarine hydrothermal centers. Fe/Mn ratios in this study are considerably lower than 0.1 and resembles submarine hydrothermal deposits.

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