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Hydrothermal Alteration in Porphyry Cu-Mo-Au Mineralizations of the Chagai Arc, Balochistan, Pakistan

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Abstract

Subduction related east-west trending Chagai Arc, located in the western part of Pakistan. This arc is the western extension of Tethyan Magmatic Belt which is about 5000 km long that extends from central Europe, Turkey, Iran and Pakistan. During the last four decades, several porphyry copper settings were reported from the Chagai Arc. Seven more famous occurrences are selected for the present study owing to more detailed work carried out on them. From west to east these deposits include Saindak, Reko Diq (formerly known as Koh-e-Dalil), Humai, Durbanchah, Missi, Ziarat Pir Sultan and Dasht-e-Kain. Hydrothermal alterations in the porphyry copper occurrences of Chagai arc are mainly associated with tonalite porphyry stocks, except Durbanchah and Humai prospects which are hosted in dacite porphyry stocks, whereas Missi Prospect occurs in a granodiorite batholith. Alteration is generally developed in a concentric zonal pattern as observed in majority of the world deposits, except that absence of a regular argillic and peripheral zone. In most of the occurrences the potassium silicate altera¬tion zone (K-alteration zone) occurs usually within the intrusive porphyry stock, but in Saindak and Reko Diq deposit, some of the adjacent wall rock sediments, and in Durbanchah setting the microdioritic country rock, has also undergone the K-alteration. Quartz sericitic or phyllic alterations zones are developed in all the occurrences as continuous or dis¬continuous haloes around the K-alteration zone except in Durbanchah prospect. In Humai prospect an advanced argillic alteration zone is developed around the K-alteration zone. Propylitic alteration has also developed in all the occurrences and generally encircles the quartz sericitic alteration.

The oxide mineralization is generally represented by goethitic jarositic, hematitic limonites and malachite, with minor pitch limonite, chrysochola, neotocite, brochanthite and molybdite. Hypogene mineralization is represented by pyrite, chalcopyrite and minor bornite. A regular supergene sulfide enrichment is only reported from the Reko Dik deposit and represented by chalcosite and covellite in other deposits restricted incipient type supergene sulfide enrichment is encountered. In terms of ore reserves the Riko Dik deposit is on the top with 2,200 million tons of copper followed by Saindak with 412 million tons and Dasht-e-Kain 350 million tons. Grade wise Reko Diq Deposit is again on the top with 0.53% Cu, 0.01% Mo and 0.3g/t Au, followed by Saindak with 0.4% Cu, 0.015% Mo and 0.35 g/t Au. Dasht-e-Kain deposit contains 0.35% Cu and 0.015% Mo. Gold has not been reported from Dasht-e-Kain deposit. From other deposits of the Chagai Arc ore reserves and grade are not reported so far.

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