Metallogeny of Manto-type Copper Deposits of Iran: A Possible Link to the Evaporitic basins

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EGU General Assembly 2022

Abstract

Iran hosts varieties of copper deposits, including porphyry Cu-Mo, vein-type, Manto-type, etc. the last is mostly hosted in basalt, basalt-andesite to andesite volcanic rocks. There are more than 40 Manto-type copper deposits and occurrences in Iran, such as Mari and Abbas-Abad, most of them economical. Geological and geochemical data indicate that most of these deposits formed within plate failed continental rift and back-arc extensional environments related to the subduction of the oceanic crust of neo-Tethys beneath the Iranian Plateau. Furthermore, the temporal and spatial distribution of these deposits shows a close relationship with evaporitic basins. This phenomenon suggests a relationship between the formation of Manto-type deposits and the circulation of brines from adjacent evaporitic basins in shallow extensional tectonic environments.

Introduction

Manto-type deposits are the second producer of copper in Iran, mostly hosted in basalt, basalt-andesite to andesite volcanic rocks. Most of these deposits occur in Eocene volcanic rocks, and a small amount of them (such as KeshtMahki, Hassanabad, Khorjan, and Simakan) are hosted in the Early Cretaceous volcanic rocks that mainly concentrated in the Saveh-Yazd (in the Urumieh-Dokhtar magmatic belt), Qazvin-Zanjan, Sabzevar-Neishabour, Semnan-Shahroud volcanic zones, and eastern Iran.

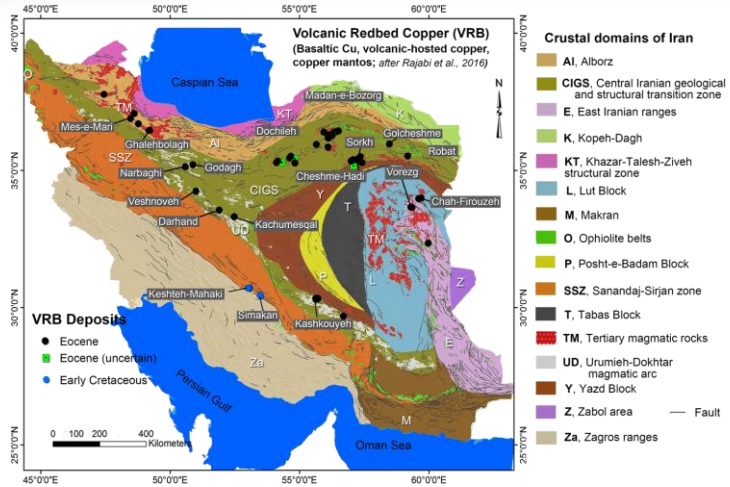

Fig2. Distribution map of volcanic red bed (Manto-type) copper deposits in different structural zones of Iran.

Mineralization and alteration

The stratabound sulfide ores in these Manto-type copper deposits include chalcocite, chalcopyrite, and bornite, associated with covellite, malachite, atacamite, chrysocolla, and minor azurite in the oxidized and supergene ore zones. Sulfide mineralization usually occurs as a replacement in pyrites and feldspars, vein and veinless, and breccia, which is accompanied by carbonatization, propylitic, and minor sericite alterations.

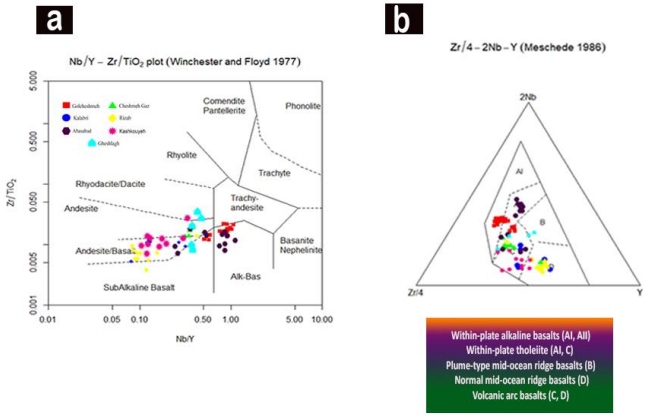

Fig1. a) Nb/Y versus Zr/TiO2 plot of Winchester and Floyd.
b) Zr/4–2Nb–Y ternary plot of Meschede

Table 1. Characteristics of some important Manto-type deposits in Iran

Deposit name	Age	Longitude (E)	Latitude (N)	Host rock composition	Commodity
Abbas-Abad	Eocene- oligocene	56°25'35.35"E	36°25'46.20"N	Andesite, andesite-basalt	Cu
Golcheshmeh	Eocene	58°41'35.34"E	35°52'46.09"N	Andesite, andesite-basalt	Cu
Kalabri	Eocene	57°25'4.64"E	35°18'32.98"N	Andesite-basalt	Cu
Cheshme-Hadi	Eocene	57°38'29.90"E	35°25'51.22"N	Andesite	Cu
Koshkouyeh	Eocene	55°35'35.20"E	30°20'30.25"N	Andesite	Cu
Cheshmeh-Gaz	Eocene	57°33'21.09"E	35°20'14.23"N	Andesite, basalt	Cu
Gheshlagh	Eocene	48°48'35.89"E	36°33'52.96"N	Basalt, basalt-andesite	Cu
Rizab	Eocene- oligocene	57°24'30.79"E	35°23'45.67"N	Basalt	Cu

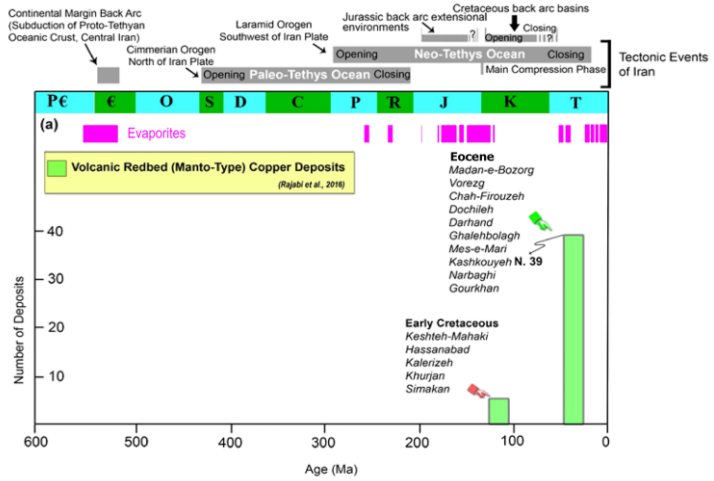

Fig3. Schematic age distribution of Manto-type copper