Deep crustal structures as controls on magmatism and copper mineralization in the Urumieh-Dokhtar arc, Iran

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The relationship between basement lineaments, volcano-plutonic suites and distribution of major copper provinces has been studied in three parts of the Urumieh-Dokhtar magmatic arc, using satellite images and geological data. This magmatic arc is the result of the closure of the Neo-Tethys Ocean and the collision of the Iranian and Afro-Arabian plates. The majority of copper deposits and occurrences in this belt are associated with subduction-related granitoids of Eocene to Miocene age, distributed in the northwestern and central-southeastern parts of the Urumieh-Dokhtar belt. The peak of copper-mineralization occurred in the Miocene. In this study, three mineralized areas were selected for detailed investigation: Shahr-e-Babak (second major porphyry copper belt in Iran: e.g., Mieduk deposit), Sungun (second largest porphyry copper deposit in Iran) and Khezr-Abad (major copper mining district in central parts of the Urumieh-Dokhtar belt). These areas have a semi-arid climate, scarce vegetation and excellent outcrops, making them suitable for the application of remote sensing techniques.

Geological and structural data and the location of the deposits were extracted from Landsat TM and IRS images, and geological maps and reports. Satellite images reveal a pattern of NW-SE faults that cross the central and southeast parts of the Urumieh-Dokhtar belt (Shahr-e-Babak and Khezr-Abad regions). These faults were reactivated during collision and they are intersected by N-S, NE-SW faults. In the northwest region, intersections of old lineaments and the Urumieh-Dokhtar belt are important in localizing porphyry type deposits.

Fracture analysis of mineral deposits, especially of porphyry type, suggests that in the 3 study areas, these deposits were formed in transtensional domains of reactivated faults, intersections of strike-slip faults and intersections of deep lineaments. Therefore, in the Urumieh-Dokhtar magmatic belt, as in other mineralized districts worldwide, brittle fractures associated to orogen-scale strike-slip structures have provided suitable permeability essential in the emplacement of volcanic centres, high-level plutons, and hydrothermal and porphyry type copper mineralization.