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Identification of Hydrothermal Alteration Zones for Exploration of Porphyry Copper Deposits Using ASTER Data

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Abstract

Alteration zones are important features for the exploration of porphyry copper deposits. The ASTER sensor is able to identify the types of alteration and its alteration zoning, which are important information for mineral resource exploration. The combined utilization of three specific images are described, 1) alteration image, 2) band ratio image, and 3) principal component analysis (PCA) image.

The alteration image is a false color image using band4, band6 and band8 (R : G : B=4 : 6 : 8). The alteration zones appear as pink or green colors in the alteration image.

The band ratio image is a color image that uses the band ratio images of band4/band6, band5/band6 and band5/band8 (R : G : B=4/6 : 5/6 : 5/8). The band ratio image is able to provide information of the alteration zoning. Band4/band6 enhances the advanced argillic alteration, band5/band6 enhances the phyllic alteration and band5/band8 enhances the propylitic alteration.

The PCA image (“Crosta technique”) is also able to provide information of the alteration zoning. The PCA image is a color image that consists of the alteration PCA images that are obtained from three PCA processes (R : G : B=advanced argillic : phyllic : propylitic). The alteration PCA image can be chosen by checking the eigen vectors. The advanced argillic alteration image is obtained from PCA of band1, band4, band6 and band7, the phyllic alteration image is obtained from PCA of band1, band3, band5 and band6 and the propylitic alteration image is obtained from PCA of band1, band3, band5 and band8. These methods are applied to the Meiduk area of Iran, which is known for porphyry copper mineralizations. Each of the methods are able to detect the hydrothermal alteration

or zonings related to porphyry copper mineralization clearly.

Keywords: ASTER, alteration mapping, band ratio, principal component analysis, Crosta technique

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