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Identification of Hydrothermal Alteration Minerals along Thanewasna Shear Zone, Western Bastar Craton, Central India: A Remote Sensing Approach

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Abstract

The NNW-SSE trending brittle ductile Thanewasna shear zone hosts epigenetic porphyry copper mineralisation in western Bastar craton, central India in Chandrapur district of Maharashtra. The identification of hydrothermal alteration minerals associated with copper mineralisation using remote sensing techniques becomes an interesting tool in mineral investigations to explore new prospects of porphyry copper deposit. The spectral signatures of the hydrothermal alteration minerals generated from Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) image were validated in the field using high resolution SVC-HR-1024i spectro-radiometer. The image processing techniques of band ratio, principal component analysis, minimum noise fraction and spectral studies were applied and their performance was evaluated for the visible and near infrared (VNIR) range (0.52-0.86 μ m) and shortwave infrared (SWIR) range (1.6-2.43 μ m) of the ASTER data. The spatial distribution of the hydrothermal alteration has been verified by the insitu spectral reflectance measurement using high resolution SVC-HR-1024i spectro-radiometer during field inspection. Spectral analysis using ENVI 5.1 software show presence of goethite and hematite bearing iron alteration, malachite and azurite bearing sulphide alteration, chlorite bearing propylitic alteration and smectite, kaolinite and montmorillonite bearing clay hydrothermal alteration zones along the shear zone at Thanewasna. Spectral analyses of soil samples collected from the Thanewasna area also confirmed the presence of illite, hematite, goethite, montmorillonite, kaolinite-smectite and corrensite minerals, which are common mineral assemblages associated with hydrothermally altered zones. The study also revealed presence of hydrothermal alteration mineral zone in Lal Heti. Therefore, the remote sensing techniques can be used in identification of hydrothermal alteration zones before launching detailed exploration program.

Keywords: ASTER, Alteration zones, Band ratio, Principal component analysis, MNF, Spectral studies, Thanewasna shear zone, western Bastar Craton, Central India.