

Abstract

Hydrothermal alteration is one of key indicators for precious ore deposits. It is useful in the reconnaissance survey for narrowing down the target area under investigation. The alteration halos are easy to locate for their larger spatial coverage compared to actual mineralized zone or ore conduits. Besides alteration chemistry and their spatial distribution provide important information regarding the direction and proximity to hydrothermal ore conduits. In this thesis, South-Purulia-Shear-Zone (SPSZ), a relatively unexplored with sparse vegetation cover, has been explored on multi-scale observations to delineate alteration and mineral potentiality. The thesis got three objectives, viz., alteration mapping, alteration characterization, and mineral potentiality mapping. In order to achieve proposed objectives, we have used an integrated Field, Remote Sensing and GIS-based approach for multi-resolution sensors like ASTER and Worldview-3 (WV-3). Different digital image processing techniques (viz., band ratio, DPCA, SPCA, SID classification) and PLSR modeling have been used for the demarcation of hydrothermal alteration zones. Besides, we have observed alternate clay banding, brecciated quartzite, ferruginous schist, and quartz sericite chlorite schist in the field. Thin section petrographic study, geochemical alteration index and spectroscopic studies have been conducted to confirm the hydrothermal origin, type, and degree of alteration. We have found argillization, ferruginisation, and silicification as dominant type of alteration with the occasional presence of sericitization and chloritization. Different alteration proxies such as Al-OH, Fe-OH, Mg-OH, Ferric iron oxide, & Ferrous iron oxide anomaly, Chemical Alteration Index, Hashiguchi Alteration Index, Carbonate Chlorite Pyrite Index, Ishikawa Alteration Index and Silicification index have been extracted remotely from WV-3. All derived thematic layers have been integrated on GIS platform for alteration characterization and mineral potential mapping. Oxide, sulfide, and phosphate mineral phases of Au, Ag, Cu, Sn, Mn, Fe, Zn, Pb, U, Th, and REE have been observed associated with the alteration. Finally, this thesis concludes that the integrated approach got potentiality to reveal mineral prospective zones, even under sparsely vegetated region.

Keywords: SPSZ, ASTER, WV-3, Alteration, Mineral potentiality, Mineral exploration