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Mineral mapping at the Ikh Shankhai porphyry Cu deposits, Mongolia using WorldView-3 data

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Southeastern Mongolia has limited access due to its extreme environments (long and harsh winter) and lack of infrastructure (e.g., road). Satellite remote sensing technique is one of the most effective methods to get geological information in areas where field survey is difficult. WorldView-3 (WV3), launched in August 2014, is high-spatial resolution commercial multispectral sensor developed by DigitalGlobe. WV3 measures reflected radiation in eight visible near infrared (VNIR) bands between 0.42 and 1.04 μ m and in eight short-wave infrared (SWIR) bands between 1.20 and 2.33, which have 1.24- and 7.5-m spatial resolution, respectively. In this study, WV3 VNIR and SWIR data were used to identify and map the various minerals in the Ikh Shankhai porphyry Cu deposit district, Mongolia.

The Ikh-Shankhai porphyry Cu deposit is located within Gurbansayhan island arc terrane in southeastern (SE) Gobi mineral belt, Mongolia. The Ikh-Shankhai district include the porphyry system containing Cu-Au with primary chalcopyrite, which is classified into disseminated type and stockwork quartz type. This district consists of Late Devonian-Early Carboniferous andesite, tuff and siltstone intruded by Carboniferous-Permian granite, granodiorite and granodiorite porphyry.

The WV 3 data were analyzed using mixture-tuned-matched filter (MTMF) which locates a known spectral signature in the presence of a mixed or unknown background. MTMF does not require knowledge of all of the spectral endmembers and is suited for used where materials with distinct spectral signatures occur within a single pixel. From the WV3 analysis result using mixture-tuned-matched filter (MTMF), we identified the location and abundance of alteration minerals. Advanced argillic minerals (alunite, kaolinite (or dickite), and pyrophyllite) were dominant in the lithocaps of the Budgat and Gashuun Khudag prospects; whereas, phyllic (illite) and propylitic (calcite and epidote) minerals were dominant in the areas surrounding the lithocaps. In addition, the distribution of ferric minerals (hematite and goethite) was mapped because of the oxidation of pyrite. Field work at the Ikh-Shankhai porphyry Cu district to evaluate the accuracy of the mineral mapping results was carried out in August, 2018. Reflectance spectra acquisition using a portable ASD TerraSpec Halo mineral identifier (the attached GPS covered a spectral range of 0.35 – 2.5 μ m) was conducted in the altered outcrops of the Ikh-Shankhai porphyry Cu district. Mineral mapping results compared well with the field spectral measurements collected for the ground truth and demonstrated WV3 capability for identifying and mapping minerals associated with hydrothermal

alteration. Evaluation of the WV3 mineral mapping results using ground truth data indicates, however, a difficulty in mapping spectrally similar minerals (e.g., kaolinite and dickite) due to spectral resolution limitation.