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Abstract

In this study, a soil geochemistry survey was conducted and most suitable pathfinder elements for the exploration of Sb deposits and anomaly distribution models of these elements were studied. In this regard, 138 samples taken from A (top soil) and B horizon of the soil were analyzed for concentrations of Ag, As, Au, Co, Cu, Fe, Hg, Mn, Ni, Pb, Sb, and Zn elements. None of these elements was subjected to the normality test, and log transformation was applied to all. In soil samples from the A horizon concentrations of Sb, As, Ag, Au and Hg are 0.36-2000 mg/kg, 4.10-4019 mg/kg, 2.0-217 μg/kg, 0.20-53.70 μg/kg and 20-1853 μg/kg, respectively. Concentrations of the same elements in the B horizon were 0.42-2000 mg/kg, 2.10-5470.40 mg/kg, 10-348 μg /kg, 0.80-66.40 μg/kg and 22-1714 μg/kg, respectively. Cluster analysis indicated that Ag, As, Au, and Hg elements are strongly correlated with Sb, and therefore, they are the most suitable pathfinder elements for the exploration of Sb deposits. Threshold values of these elements were determined with the use of median absolute deviation (MAD) method. In addition, an anomaly map of each element and the element groups yielding the most ideal results for the exploration of Sb deposits were also ascertained with the multi-element mapping technique. Results indicate that As + Au and Ag + As + Au are the most ideal multi-elements in the exploration of Sb deposits. In this method, some elements that yield weak anomalies when solely used were found to be effective when combined with other elements. These element associations can be successfully used in future Sb geochemical exploration works.
The t-test and proportioning method reveal that element concentrations of samples collected from both zones exhibit no significant difference. According to enrichment factor (EF) and integrated pollution index (IPI) calculations, both A and B horizons of the soil are enriched in all examined elements. Element enrichment in A horizon is in the rank of Sb>As>Ni>Au>Hg>Co>Cu>Mn>Zn>Pb>Cd>Cr, while the rank of elements in B horizon is Sb>As>Ni>Hg>Au>Co>Cu>Mn>Cr>Zn>Pb>Cd. A horizon is represented by significant Sb and As enrichment; very high Ni, Au, Hg, Co, Cu, and Mn enrichment; and moderately high Pb, Cd, and Cr enrichment. B horizon is characterized by significant Sb and As enrichment; very high Ni, Hg, Au, Co, Cu, Mn, and Cr enrichment; and moderate Pb-Cd enrichment. According to integrated pollution index calculations, 44.9% of samples from the A horizon and 44.11% from the B horizon exhibit an extremely high level of pollution.

Keywords: Geochemical exploration, Soil, Antimony, Turhal, Turkey