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Geochemical variability of major and trace elements and their role in abiotic stresses

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Abstract

Geochemical variability in rocks collected from profile section, drilling core and random samples from NIASM site has been studied using x-ray fluorescence spectrometry. The sum total of all the major oxide analyses show variable degrees of weathering and range from highly weathered samples to fresh rock. Analyses were used on an anhydrous basis in the SINCLAS programme to recalculate major oxides and normalise the geochemical analyses to 100. The programme also gives a rock name following the TAS diagram as well as fixes the Fe_2O_3 : FeO ratio and then calculates the norm. Based on the normative mineralogy and SiO_2 vs. $\text{Na}_2\text{O}+\text{K}_2\text{O}$ content in the TAS diagram the present samples were classified into sub-alkaline basalts, basaltic andesites and andesite. Major oxide variation diagram in the Main Pit indicated silica and alumina oxides tend to accumulate towards the upper parts whereas TiO_2 and FeO tend to be mobile in an oxidizing environment and get leached towards the lower parts of the weathering profile. The unique lobate geometry of the lava flow does not weather uniformly resulting in a rather jagged oxide variation diagram which is predominantly a function of the lobe geometry and the porosity and permeability of the lobe sub-units. The Mg# of the subalkaline basalt indicates moderately evolved magmas. The trace element Cu and Ni have a distinctly opposite signature as compared to Zr, V, Cr, Zn, and Co. Concentration of Ba, Sr and Rb are invariably high in the upper and lower parts of the Main Pit which is due to modal variations in the plagioclase content or due to the variable mobility of these elements in response to differential weathering across the Main Pit profile. Anomalous concentration of different major oxides and trace elements at 50 cm and 70 cm depth is due to presence of the thin clay horizons related to weathering of glassy rind of a single 20 cm thick pahoehoe toe. Such anomalous accumulations could suggest that the clays provide suitable sites for their adsorption or that considerable enrichment of these elements takes place due to deposition of soluble salts in an oxidizing environment.

Keywords: Geochemical variability, abiotic stresses, basalt, pahoehoe toe