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Mineralogical and geochemical studies of mafic and felsic rock weathering profiles from Southern Bundelkhand Craton, Central India: implications for elemental mobility and climate control

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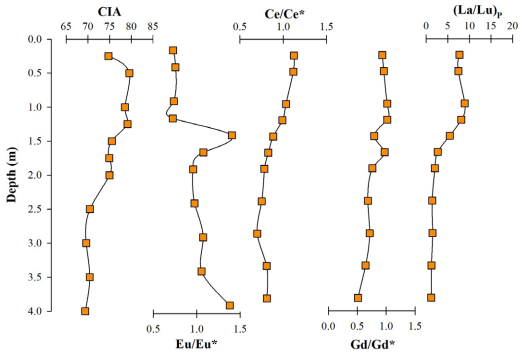

In this work we have investigated the chemical characteristics of weathering profiles developed on granite, basalt and amphibolite (enclave) from southern Bundelkhand craton, central India. The climate condition prevailing in the study area is dry sub-humid to semi-arid condition. Two adjacent weathering profiles (> 4 m) developed on granite and intruded basalt dyke, as well as, amphibolite enclave display discriminative appearance from each other. X-ray diffractometer (XRD) analysis show the dominance of quartz and clay minerals, where illite dominated clay mineral in soil layer of both profiles and chlorite and smectite dominate saprolite. In the case of amphibolite enclave, hornblende and chlorite were the dominant mineral phases. The chemical index of alteration (CIA) and other indices show incipient to moderate weathering intensitiesfor granite (CIA = 47.89 to 80.1) and basalt (CIA = 66.57 to 79.55) profiles and incipient degree of weathering for amphibolite enclave (CIA = 52.21 to 58.25). Calculations of elements mobility reveal interesting variations in the behavior of elements within the profiles. In granite profile, SiO_2 and Na_2O were the only mobile elements that leached out from the profile, while in basalt profile and amphibolite enclave, almost all major oxides were depleted to different extent. This perhaps indicates the significance of parent rock composition on element behavior during weathering and pedogenesis process. Trace and rare earth elements (REE) concentrations are fluctuated with general depletion trend in granite profile and amphibolite enclave, which is extremely different from basalt profile where there is retention of some trace elements and LREE especially in soil layer of the profile. This may be attributed to adsorption of the trace elements onto the secondary phases. La/Lu, Eu/Eu*, Ce/Ce* and Gd/Gd* indicate oxic weathering environment and higher fractionation in basalt profile when compared to other profiles. Results of mass balance calculations are close to zero which indicate iso-volumetric weathering for both profiles. It may be concluded from the present study that the chemical weathering varies from one profile to another and within different sections of a single profile, where various weathering agents (e.g., primary mineral, climate, biota...etc.) can influence weathering process and pedogenesis.