

BASALTS WEATHERING FROM THE FRENCH MASSIF CENTRAL: BEHAVIOUR OF NI, CR, ZN AND CU FROM THEIR RELEASE TO THEIR TRAPPING IN AUTHIGENIC PHASES.

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ABSTRACT

The behaviour of Metallic Trace Elements (MTE) during weathering of basalts is examined in a moderate temperate climate. Samples of unweathered basalts, weathered basalts and strongly weathered basalts are studied in 6 sites of the French Massif Central. The sampled parent basalts and basanites are rich in Cr (248-455 mg/kg) and Ni (126-237 mg/kg). Chromium and Ni are present in similar amounts in weathered and strongly weathered samples. MTE localisation is investigated by optical and electronical microscopy (EMPA, SEM-EDS). In parent basalts, chromium is present in Cr-spinels (4 - 42 wt %), Fe-Ti spinels (0.12 – 1.24 wt %) and Ti-augite (200 – 8000 mg/kg), whereas nickel is incorporated into forsterite (830 – 3600 mg/kg) and spinels (0.11 – 0.14 wt %). Copper and Zn are found at lower concentrations but regularly throughout the studied phases. In weathered samples, authigenic phases fill fractures and also replace primary minerals. They are composed of mixtures of clays, iron oxides and organic compounds. Authigenic phases contain smaller amounts of MTE than the primary minerals but authigenic phases are more abundant. Under moderate weathering conditions, only 20 to 40 % of the total content in MTE appears to be mobile during the development of soils on the basalts. As spinels are not affected by strong weathering under temperate climate, only the fraction of Cr, Ni and Zn present in the silicates of the parent basalts is released.

Keywords: metallic trace element, basalts, weathering, forsterite, spinel, iddingsite, alteration sequence.