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Distribution of Thorium, Cesium, Yttrium and Zirconium in Alfisol pedons in the Catalan Coastal Range (NE Spain)

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The aim of this study is to estimate the concentrations and vertical distributions of Th, Ce, Y, and Zr in eleven Alfisol pedons from the NE Garraf Coastal massif (Catalonia, NE Spain). These soils were developed mainly on Mesozoic limestones. The concentrations were determined by XRF and the results were then compared to soil properties (pH, organic carbon content, $CaCO_3$, particle size distribution and Fe forms: total iron, Fe_t, dithionite-extractable iron, Fe_d and oxalate-extractable iron,Fe_o). The range of Th values is: min 3 $mgkg^{-1}$, max 16 $mgkg^{-1}$, mean 10.4 $mgkg^{-1}$ and median 11 $mgkg^{-1}$. The range of Ce values is: min 22 $mgkg^{-1}$, max 116 $mgkg^{-1}$, mean 73.9 $mgkg^{-1}$ and median 76 $mgkg^{-1}$. The range of Y values is: min 10 $mgkg^{-1}$, max 43 $mgkg^{-1}$, mean 27.5 $mgkg^{-1}$ and median 27 $mgkg^{-1}$. The range of Zr values is: min 101 $mgkg^{-1}$, max 418 $mgkg^{-1}$, mean 253 $mgkg^{-1}$ and median 252 $mgkg^{-1}$. The Th concentrations obtained are similar to world soil and NASC values. These concentration data of Th, Ce, Y and Zr were correlated with each other and with the soil properties. Th correlates positively with Ce (0.95), Y (0.92), Zr (0.80), Fe_t (0.75), Fe_d (0.85) and Fe_d-Fe_o (0.85), clay% (0.55) and silt% (0.31) and negatively with sand% and $CaCO_3$. The correlations do not indicate any significant relationship between Th and organic carbon or Fe_o. The ranking of the horizons by Th concentration is: BC hor. (12.5 $mgkg^{-1}$), Bt hor. (11 $mgkg^{-1}$), A hor. (10.1 $mgkg^{-1}$) and finally C horizons (7.2 $mgkg^{-1}$). The ranking of the Alfisols by Th concentration, taking into account the litology is: those derived from limestones (14.5 $mgkg^{-1}$), those derived from schists (12.5 $mgkg^{-1}$), those originated over dolomites (11.8 $mgkg^{-1}$), those developed over Pleistocene colluvium (9.2 $mgkg^{-1}$) and finally those originated over Keuper marls (6 $mgkg^{-1}$).