



## **New geochemical climofunctions dedicated to Calcisols – input to the reconstruction of the paleoclimate of southwestern Europe during the lower to middle Miocene**

Thomas Gillot (1), Isabelle Cojan (1), David Badia (2), and José Antonio Cuchi (2)

(1) MINES-ParisTech, PSL University, Geosciences, 35 rue Saint Honoré, 77300 Fontainebleau, France (thomas.gillot@mines-paristech.fr), (2) Technic School of Agrarian Engineering and Environmental Sciences, University of Zaragoza, Carretera de Cuarte, Huesca, Spain

Many classic climofunctions based on the quantification of the leaching processes soils have been developed to reconstruct paleoclimate parameters from paleosols (mean annual precipitation (MAP), mean annual temperature (MAT) and mean annual range of precipitation (MARP)). In Calcisols, due to the interactions between the leaching and accumulation processes, the classic geochemical climofunctions cannot be applied. Morphologic ones, based on the depth and thickness of the horizon of carbonate accumulation (Bk), can only be used on well preserved profiles. Specific climofunctions dedicated to Calcisols, frequently top-truncated in alluvial geological successions, must thus to be developed to complete the paleoclimate reconstructions.

Two new specific climofunctions allowing reconstructing MAP and MAT are developed from the geochemical analyzes (using XRF in situ and ICP-AES methods) of modern Calcisols from northeastern Spain coupled with the study of modern climatic parameters. These functions are based on the comparison of elemental ratios through the Bw or Bt horizon compared to those of the C horizon. This method can be applied to truncated soils, as long as part of the B horizon is preserved.

Their application to more than 70 paleosols from the lower to Middle Miocene of SE France and Central Spain firstly highlights a good agreement between the results of the climofunctions based on morphologic characteristics and those based on the major element geochemistry. It also indicates a low latitudinal gradient between the two considered regions (MAT between 13 to 19°C and MAP ranging from 250-700 mm/yr). The estimated MAT are within the range of those estimated from northwest Europe, Portugal and northern Spain. Conversely, the estimated precipitations in our study are two times lower than in the other regions. Such results raise the question of a proto-Mediterranean climatic belt as early as lower Miocene in south eastern France and Central Spain...