CLAY - ORGANIC MATTER INTERACTIONS IN THE SOIL ENVIRONMENT - 30 YEARS OF PERSONAL CONTRIBUTIONS AND PERSPECTIVES FOR FUTURE RESEARCH

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Most of the organic carbon in soils is associated with the clay fraction. The principal soil organic components are humic substances, which are usually classified as humin, humic acid and fulvic acid, based on their solubility in acid and alkali. Interactions of humic substances with clays form associations of widely differing physical, chemical and biological stabilities, which affect various soil properties. Among humic substances, fulvic acid (FA), soluble in both acid and alkali, is completely soluble in water at all pH values and is considered to be the most active fraction. The interaction of FA with clays, therefore, became the prime objective of the investigation. In collaboration with Morris Schnitzer the investigation was initiated about 30 years ago at what was then Soil Research Institute of Agriculture Canada. The results of this investigation indicated the following: 1) a FA solution is efficient in dissolving mafic minerals, due to its ability to complex metal ions, 2) the extent of FA adsorption on external mineral surfaces depends on the physical and chemical characteristics of the surface, the pH of the system and its water content, 3) once adsorbed on clays the solubility of FA in water of the FA decreases, 4) in some instances clays appear to behave as templates which change the nature of FA molecules from hydrophilic to hydrophobic, 5) expandable clay minerals can absorb FA in their interlayer sites as a function of pH of the system and the reaction is influenced by interlayer cation species, 6) the presence of FA retards crystallization of minerals, and 7) as an aggregate architecture, mineral - organic matter associations may play an important role in influencing living habitats in soils. These findings have been useful for explaining and understanding some phenomena occurring in soils. However, now looking back on this research, it is clear that much remains uncertain and unexplored. Some examples will be presented.