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Role of carbonates in soil organic matter stabilization in agricultural Mediterranean soils

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Carbonated soils are present in many semiarid areas, where lithogenic and secondary carbonates are important constituents of the soil mineral matrix. The presence of $CaCO_3$ in calcareous soils has been described as an organic matter stabilization agent mainly due to chemical stabilization mechanisms. In two recent studies in the north of Spain the importance of $CaCO_3$ on soil physical characteristics was highlighted, as they were observed to be acting as macroaggregates stabilization agents. A third study was carried out on the same experimental site, with the hypothesis that the observed differences in aggregation may favor organic matter stabilization in carbonate-containing soils. With that aim we studied the soil physical characteristics (water retention and porosity) and the bioavailability of soil organic matter (SOM) in the two contrasting soils in that site, one Typic Calcixerept (CALC) and one Calcic Haploxerept (DECALC). Bioavailability was evaluated trough the measurement of mineralization rates in a 30 days soil incubations. Intact and disaggregated samples were incubated to evaluate the effect of physical protection on SOM bioavailability in whole soil and macroaggregates 2-5 mm samples. Therefore, four fractions of each soil were studied: intact whole soil < 5 mm (I-WS), disaggregated whole soil (D-WS), intact macroaggregates 2-5 mm (I-Magg), and disaggregated macroaggregates (D-Magg). Soil organic carbon content was greater in CALC and had smaller mineralization rates during incubation, indicating a smaller organic matter bioavailability for microbial decomposition. However, the greater increment of mineralization observed in DECALC after disaggregation, together with the scarce differences observed in physical characteristics among both soils, indicate that physical protection was not responsible of greater SOM stability in CALC soil. New hypotheses are needed to explain the observed better protection of organic matter in carbonate-rich Mediterranean soils.