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Use of palaeopedology to improve Quaternary geological mapping in Tuscany, Italy

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This presentation focuses a joint research in Quaternary geology and pedostratigraphy. Taking the chance of contemporary programs for soil and geological maps, a joint correlation program was started in the Cecina watershed in Tuscany, Italy. The aim was definition of the stratigraphic significance of the paleosols known to be common in this area, and their correlation with the revised stratigraphy of well represented Quaternary formations. The results pointed out the opportunities for strict integration of Quaternary geological mapping and paleosol investigation. The kind of geomorphic evolution indicated by this research was different from straightforward terracing dynamics. It appeared that the most important Pleistocene soil-bearing surface was produced by reworking of aeolian deposits over a pre-existing surface; this last had been only moderately eroded, with preservation of substantial portions of the soil cover. The trend continued in terminal Pleistocene and Holocene; progressive tilting of the whole lower reaches of the watershed prevented deep dissection, while gentle reworking redeposited eroded materials on top of pre-existing soils. In this context, paleosols, and more recent soils too, could not be used as straightforward surface markers. As most soils were actually made up by geometrical superposition of products from different soil-forming events, and since soil genesis was not necessarily arrested by the, generally shallow, burial depths, accurate analysis of the observable soil columns was required. It was found that an integrated approach gave the most useful results; a pedogenetical investigation was able to pinpoint a lot of inconsistencies in soil horizon sequences, evidencing the possibility to distinguish between horizon sequences of genetic, or just geometrical, origin. However, simple pedogenetical inference was inadequate to evidence and understand all unconformity surfaces hidden within “soil profiles”. Observation of physical stratigraphy was fundamental in several cases, for

two main reasons. First, the most developed soils were not so strongly differentiated. Second, frequent lithological discontinuities were present, due to an intrinsic trend towards alternating sandy and gravelly layers in the alluvial formations. It was not always possible to mark such discontinuities as unconformity surfaces, while pedogenetical inference was not always reliable across highly contrasting parent materials. It was then the opportunity to observe the nature of the physical contact between the sediment layers that allowed to define the issue. In overall terms, such an integrated field approach, coupled with in-depth pedological investigations, such as soil clay mineralogy and soil micromorphology, allowed to establish "soil units" of various ranks. These could be consistently correlated with "morphostratigraphic" and straight stratigraphic units. This kind of correlation across the board laid the foundations for further palaeoenvironmental investigations to take full advantage of the fairly extensive and accessible Pleistocene outcrops.