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Paleosols in a Pleistocene intermontane basin: a micromorphological approach to the study of the High Agri Valley (Southern Italy)

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Integration of stratigraphical, sedimentological, geomorphological and geopedological (mainly micromorphological) methods with different dating techniques (radiocarbon, optically stimulated luminescence and apatite fission-track) is used to define the stratigraphic architecture and quaternary evolution of the High Agri Valley, a wide intermontane basin located in the Lucanian Apennines (Southern Italy). The exposed part of the syntectonic basin fill (with a thickness of more than 100 m) crops out in the south-eastern sector of the basin and is represented by a group of clastic units, of Mid-Upper Pleistocene age, which were deposited in alluvial fan, alluvial plain, fan delta and lacuo-palustrine environments. This succession consists of several units bounded by surfaces which can be associated with preserved weathering profiles and/or paleosols. The latter developed at the top of lateral alluvial fans (from both the northern and southern sides of the basin) and on the NW-SE axial alluvial plain, during geomorphological stability stages. The geopedological characterization and stratigraphic correlations have been carried out by means of the analyses of six weathering profiles, corresponding to deeply truncated paleosols, developed on proximal, middle and distal fan deposits and the sixty one on alluvial plain deposits. The profiles are distinguished based on field-work, grain-size, chemical and mineralogical analysis, as well as micromorphological observations of thin sections. Field-based profile descriptions indicate that all the pedological bodies are incomplete due to the absence of topsoil. This is interpreted as a consequence of the post-stability erosion of the studied surfaces, suggesting that repetitive cycles of aggradation, stabilization, pedogenesis and subsequent erosion occurred both through the lateral alluvial fans and the axial plain settings. The erosion and the successive burial of these paleosols occurred during

phases of climatic change. The lateral continuity and correlability of the weathering profiles is highly variable, ranging from tens to thousands of metres. This variability is due to differences in the relief, drainage, stability and sedimentation rates which characterize the fan and alluvial plain environments. Two paleosols provided key-surfaces used for correlations at the basin-scale. The oldest one corresponds to a deep fersiallitic weathering profiles (highly rubification) with frequent clay coatings. The deepest part of this paleosol corresponds to a saprolite locally showing the influence of pedoplasmation. The overlying layers (Bt horizons) also contains saprolite fragments, but following pedogenic processes are indicated by striated b-fabrics, strong clay illuviation and Fe-Mn concretions. These strongly weathered profiles appear to be related to long-cycle pedogenesis rather than extreme paleoclimatic conditions. The younger paleosol consists of an andisol which developed as a result of the weathering of a tephra layer, formed by alkali trachytic and porous ash. Neogenesis of crystallized clay minerals in this pedogenic body is limited. This level is expected to offer a good geochronological marker as a result of the dating of the pyroclastic apatites currently in progress. The correlation of the pedological features of this weathered ash and volcanic glass layer with the equivalent paleosols developed on alluvial parent materials, provides a valuable marker bed of basinwide extension and chronological significance. Moreover, if available, age determination of the volcanic parent material will permit a more thorough evaluation of the duration and intensity of the pedogenetic processes. From the micromorphological point of view, all the paleosols of the High Agri Valley show relict features, which can be related to pedogenetic processes not in equilibrium with the present-day environmental condition. In addition, they often show polycyclic characteristics too, attesting distinct pedogenetic phases, consistent with paleoclimates, spanning from semiarid to warm and, moderately wet, with clear seasonality of water deficit. In conclusion, this work has confirmed that an integrated study of paleosols (morphology, micromorphology, chemical analysis, clay mineralogy) in combination with the classical stratigraphical and sedimentological methods of the stratigraphic boundaries can give a significant contribution to the paleoenvironmental and paleoclimatic recostruction in a continental, tectonically mobile setting. The most important results are: a) the polyciclic and polygenetic imprint of some significant pedogenetic processes (i.e. different generations of clay coatings or infillings, dissolution/precipitation of pedogenic carbonates); b) the repetitive occurrence of typical interglacial conditions characterised by high temperatures and humidity with clear seasonality of water deficit; c) some information in the chronological reconstruction of climatic phases and associated sequence of morphodynamic and pedogenetic events during the Quaternary.