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Paleoclimatic, paleoenvironmental and paleotectonic significance of Middle Jurassic Fe concentrations of Central Sardinia (Italy)

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In Central Sardinia (Italy), sub-economic concentrations of iron ore are diffuse along and close to the Middle Jurassic “Alpine Tethyan Unconformity”, featured by a Variscan metamorphic substratum covered by the unconformable terrestrial Middle Jurassic Genna Selole Fm. Sedimentological and pedological investigations have been carried out to document the location and the distribution of the several Fe concentrations along the “Alpine Tethyan unconformity”, to identify the key controlling factors of the processes leading to those concentrations, and to investigate the type and the level of the alteration processes developing at the base and into the terrestrial Genna Selole Fm. In particular, we investigate several different stratigraphic situations, with a focus on their paleotectonic, paleoenvironmental and paleoclimatic significance.

Transformation processes showing complex features such as alteration halos, mineral dissolution and reprecipitation, or pedogenetic profiles have been documented. Thus, several processes suggesting phases of variable duration of uplift, exposition to the external agents and erosion of the Variscan basement, and periods of sediment starvation of the superposed Genna Selole Fm deposits have been noted. Additionally, pedological processes occurred during the slowing down of the sedimentation of the superposed Genna Selole Fm itself. The alteration deposits differ according to their stratigraphic location. They are from solid, discrete masses to thin beds, crusts and veins of Fe oxides. They may be of supergenic origin or related to sedimentary processes. The “Ferro dei Tacchi” concentrations are Fe supergenic enrichment deposits and are goethite- and hematite-rich. They are related to the selective erosion/dissolution of the basement and of its superposed cover and to the fluctuation of the water table connected with the coeval rise and sink of tectonic blocks. The Fe source may originate from a previous accumulation of laterites that was completely dismantled just before the marine transgression or, more unlikely, from the dissolution of significant amounts of pyrite contained in the NE Lithofacies of the Genna Selole Fm. Other mechanisms of Fe concentration involve oxidation by drying of Fe-rich waters, sedimentation on the bottom of bogs, and ephemeral cessations of marine sedimentation. Although the dominant climate of the Middle Jurassic was a wet-humid one, some sedimentary features, such as subaerially generated Fe oxide sedimentary crusts or possible drying of the groundwater, suggest ephemeral subarid periods. Although the areal distributions of the “Ferro dei Tacchi” hematitic/goethitic ore bodies and of their dismantling products are discontinuous in thickness and concentration and are connected with groundwater fluctuations, they delineate precise areas of lasting emersion of the Variscan basement during the Middle Jurassic and mark sharp uplift events that may have reshaped the former erosive surface. The occurrence of Plinthosols, beyond the supporting of wet-humid climate, suggests the presence of dry areas with no sedimentation or slow rates of sedimentation in the swampy environment of the Nurri-Escalaplano Lithofacies of the Genna Selole Fm.

These results provide additional data to 1) better define the depositional environments of the Middle Jurassic Genna Selole Fm, 2) indicate the episodic presence of ephemeral subarid periods in a

dominantly humid Jurassic climate, and 3) document the tectonic evolution of a well-delimited area during this period. Moreover, this investigation shows how the interdisciplinary use of sedimentological and pedological data can be helpful for paleotectonic, paleoenvironmental and paleoclimatic reconstructions.

