

Marine submerged soils in Torre del Cerrano Park, Adriatic Sea (Italy)

Giuseppe Corti¹, Stefania Cocco¹, Valeria Cardelli¹, Silvia Pedicini², Rogerio Rogerio Borguete Alves Rafael¹, Francesco Bigaran¹, Emiliano Stazio¹, Marta Matalucci¹, Alberto Agnelli³, Flavio Fornasier⁴

1: Dipartimento di Scienze Agrarie, Alimentari ed Ambientali, Università Politecnica delle Marche,

2: Università di Teramo,

3: Dipartimento di Scienze Agrarie ed Ambientali, Università degli Studi di Perugia, Perugia, Italy,

4: Consiglio Ricerca e Sperimentazione in Agricoltura- Centro Ricerca Studio delle Relazioni tra Pianta e Suolo, Gorizia.

Intertidal habitats have captured the attention of many scientists and offered an interesting challenge for pedologists who moved into sub-tidal territories around the turn of the last millennium (Demas and Rabenhorst, 1999; 2001). The first researches on this theme were run in USA, in particular on Sinepuxent Bay (Maryland) and Indian River Bay (Delaware), where it was observed that shallow water sediments undergo pedogenic processes and are systematically distributed across subaqueous landscape. Hence, the concept of sediment as “unconsolidated geologic material” was substituted by that of “subaqueous soil”, which should be studied with proper methodologies. For these “new” soils, a revision of the equation for soil formation was proposed so as to include genesis and distribution of subaqueous soil. This entrance followed a change by the USDA—NRCS in soil definition when they published the second edition of the Soil Taxonomy (Soil Survey Staff, 1999). The revised definition allowed pedologists to define “subaqueous soils” what marine scientists normally identify as subtidal sediments or sedimentary deposits. The term “subaqueous soils” is difficult to conceptualize for marine and freshwater scientists who share a common interest in shallow water environments. According to Kristensen and Rabenhorst (2015) the terms “sediment” and “soil” to describe the substrata in coastal environments occupied by mangrove forests, saltmarshes and sea-grass beds are not mutually exclusive. Coastal marine substrata will still be denoted “sediments” by most marine scientists, while pedologists will use the term “soils” when justifiable according to the definition. The fact remains that research methodologies must be appropriate to the studied environment. Following a pedological approach, we studied subaqueous soil transects within a Marine Park of the Adriatic sea (Italy) in order to evaluate the anthropic pressure on the evolution and quality of the submarine soils. We compared disturbed (trawling fishing) and undisturbed (protected for 7 years) soils at the bathymetries of 2, 4, 6, and 8 m. Soils were retrieved by a mechanical grab bucket mounted on a boat, and removed by using a plastic blade that allowed us to obtain a stable and relatively undisturbed soil profiles showing the first 2 or 3 horizons. The profiles were described according to Shoneberger et al. (1998), providing additional characteristics like, for example, presence and number of animals (bivalves, gastropods, worms, etc.). The samples were dried and analyzed for their main physical, chemical and biological properties. In both marine areas, even at 8 m of bathymetry, we observed great morphological and analytical differences between the superficial C horizon (recently deposited sediments) and the underlying A horizon (pedogenized sediments), and attributed the changes to marine organisms living in the A horizon (mainly bivalves). Hence, submarine soils are important examples of pedogenesis led by animals that, with their effect of bioturbation and the excretion of organics, foster the activity of a microbial population able to change C horizons into A horizons. Analogous to the “rhizosphere effect”, which is often responsible of considerable pedogenic changes, we would refer to this phenomenon as a “zoosphere effect”, whose action is mainly detectable in Wassents. We also provide a theoretical reinforcement to the submarine pedogenesis debate and are confident to expand soil horizons till maritime territories with 8 m of bathymetry, provided that sediments are prone to pedogenesis.