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Sources and contamination rate of port sediments: evidences from dimensional, mineralogical, and chemical investigations

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Ports are complex environments due to their complicated geometry (quays, channels, and piers), the presence of human activities (vessel traffic, yards, industries, and discharges), and natural factors (stream and torrent inputs, sea action, and currents).
Due to the many activities that take place in a port, sediments and waters are often contaminated by different kinds of chemicals, such as hydrocarbons, dioxins, pesticides, nutrients, and metals. The contamination rate of a port basin is site specific and depends on the sources of contamination in the nearby urban system as well as the port system itself, such as city discharges and sewers, river intake, vessel traffic, factories (Taylor and Owens, 2009). Moreover, two important sources and vehicles of contaminants are: a) anthropogenic road deposited sediments derived from the runoff of the port and city area, and natural road deposited sediments derived from rivers and torrents, and b) airborne particulate matter and sediments (Taylor and Owens, 2009).

The Port of Genoa is situated at the apex of the Ligurian Sea in the north western Mediterranean Sea and is characterised by the presence of several commercial activities that have contributed, over the years, and still contribute today, to the contaminant accumulation in both the water column and the bottom sediments. This port basin includes the mouth of several streams and the mouth of the Bisagno and the Polcevera Torrents, along the banks of which can be found several small towns, quarries, factories, and the suburbs of the city of Genoa, a ferry terminal, different container terminals, marinas, dry docks, the coal power plant of Genoa, and different wastewater treatment plant discharges.

Starting from these considerations, we have examined the marine environment of a port from the point of view of the water mass circulation, hydrological characteristics, distribution of the sediment grain size, mineralogical characteristics, and metal concentrations of the bottom sediments. Our results show that, in the case of the Port of Genoa (north western Italy), both the impact of the human activities (such as coal power plant, oil depots, yards, dredging of the bottom sediments, etc.) and the natural processes (such as currents, fresh water and sediment inputs from the torrents), together with the morphology of the basin, are important factors in sediment, water and metal distributions and give rise to a complex environment.

Taylor, K.G., Owens, P.N., 2009. Sediments in urban river basins: a review of sediment contaminant dynamics in an environmental system conditioned by human activities. Journal of Soils and Sediments 9: 281-303.