

Characterization of the coastal area facing Cogoleto (Ligurian Sea): areal and historical distribution of chromium

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Introduction: The marine coastal area facing the town of Cogoleto, in the Ligurian Sea, is well known for having been subject to the uncontrolled discharge of wastes containing large amounts of Cr [1]. Because of this it has been listed among the reclamation sites of national interest. This implies the design and the implementation of characterization plan according to the set of rules approved by the Italian Ministry of the Environment. This work discuss the results of the characterization campaign in comparison with those obtained from an in deep study to enlighten the detailed of input history and trends.

Methods: For the characterization, 200-300 cm long sediment cores were retrieved using a vibrocorer (self-sheating-hydraulic-sampling bottom device). From 200 cm cores were sampled intervals 0-10cm, 10-30, 30-50, 100-120 and 180-200 cm; from 300 cm cores was sampled also the section 280-300 cm. For the complementary study, a gravity corer was used, especially designed to preserve an undisturbed top. In this case, the core was extruded and sectioned to obtain slices 1-4 cm thick, with higher resolution close to the interface. After collection some core were scanned for whole-core magnetic susceptibility. Sampling sites are shown in Fig. 1. Metals (Al, As, Cd, Co, Cr tot, Cr VI, Cu, Fe, Hg, Mn, Ni, Pb, V, Zn) were analyzed by AAS after complete dissolution of the samples with HNO₃, HF and HCl in a microwave oven. ²¹⁰Pb and ¹³⁷Cs, used for dating purposes, were determined by alpha and gamma spectrometry. Grain sizes were obtained using sieves and, for silts and clays with an X-ray sedigraph.

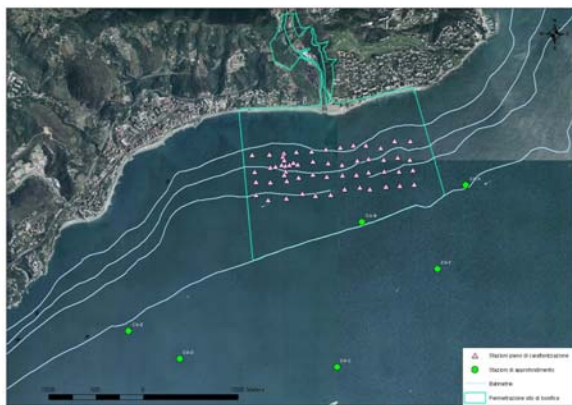


Fig. 1: Study area and sampling locations.

Results and discussion: Grain size analysis and chronologies confirmed a higher influence of terrestrial sediment inputs near the coastal line and the Lerone river mouth, with higher sand contents and higher accumulation rates (0.7-0.3 cm y⁻¹) for those cores located near shore (CG-A, CG-B and CG-12).

Results confirmed that the area is substantially polluted by heavy metals and particularly by Cr, whose values (1000-10.000 mg kg⁻¹) are always higher than ERM guidelines (370mg/Kg). Concentration-depth profiles from characterization clearly show that maximum values can be found at intermediate depth with a decreasing trend. However, Cr is a component of many iron oxides/hydroxides minerals and chromites are often associated to serpentine minerals that were found in discrete quantities in all samples. Therefore, the problem of establishing a background value was taken into consideration and values of 500-1500 mg kg⁻¹ were suggested. However, since it was not possible to define a unique and unambiguous background level for the area, the profiles relative to the high vertical resolution study were normalized with respect to Ni. Cr/Ni distributions with depth suggest that Cr concentrations are still maximum in the surficial or subsurficial sediment (a slightly decreasing trend is only suggested at some sites).

To establish a link between the low resolution cores of the characterization and the high resolution cores of the chronological study, magnetic susceptibility depth profiles can be compared with a resulting integration between all the information available. However, it appears that the degree of information obtained by a number of cores analyzed with sufficient vertical resolution is much higher than that provided by a high number of cores sampled at discontinuous intervals more than 10 cm thick. This means that the high resolution analysis of a few cores could significantly reduce the number of sampling sites needed for the characterization of the area of interest.

References: [1] Bertolotto et al. (2005) *Mar Poll. Bull.* **50**:348-356;

[2] ARPAL (2004) Caratterizzazione dei bacini metaofofilici dei Torrenti Leira e Lerone.