



Special Issue on geophysical processes in ABBaCo project (environmental restoration and bathing at SIN Bagnoli-Coroglio, Southern Tyrrhenian Sea)

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Special Issue on geophysical processes in ABaCo project (environmental restoration and bathing at SIN Bagnoli-Coroglio, Southern Tyrrhenian Sea)

ABSTRACT

This paper intends to provide the reader with an overview of the Special Issue (SI) on ABaCo project, an extensive research project aimed to characterise the environmental quality and a possible remediation and restoration strategy of the marine area impacted by the Bagnoli industrial site. The main focus of this SI is to provide an up-to-date and comprehensive overview of the physical environment of the Bagnoli-Coroglio Bay (Gulf of Napoli, southern Tyrrhenian Sea) of the geophysical processes controlling the sediment dynamics and of the resulting pollutants distribution. Through eight contributions, an ensemble of interdisciplinary articles has been collected, emphasising the importance of tackling technical and scientific problems at different scales and from different points of view.

KEYWORDS

seafloor morphology; seafloor sedimentological mapping; physical and dynamical oceanography; coastal area; waves

Dismissed industrial activities are responsible for persistent environmental degradation, mainly due to long-term accumulation of xenobiotic contaminants in the environment. Such a chronic form of pollution represents a major threat for human health, biodiversity and ecosystem functioning. Necessary environmental remediation practices should, however, be coupled to restoration plans aiming at reverting the degradation trend and give back healthy areas able to provide valuable ecosystem goods and services. The environmental restoration of Bagnoli-Coroglio Bay is a unique challenge at European level.

The collected contributions reported in this SI are part of an extensive research project (ABaCo [1]) aimed to characterise the environmental quality and a possible remediation strategy of Bagnoli industrial site.

ABBACO [1] developed new approaches for the removal and remediation of contaminated sediments and restoration of marine habitats. Actions included: (i) identifying the environmental benchmark of the area, (ii) assessing its present health status, (iii) studying the effects of contaminated sediments on biodiversity and ecosystem functioning (MSFD), (iv) assessing the combined effects of multiple stress at a hierarchical level, (v) experimenting innovative methods of transplantation and restoration of key species and habitats, and new biotechnological instruments for the remediation of sediments (bioremediation, bioaugmentation) in degraded habitats.

This Special Issue includes eight papers related to the first of these actions and supplies the basic information on the distribution in the area of the contaminants originated by the operation of the Bagnoli industrial plant and on the geophysical processes responsible of the observed distribution. It provides information on the areal extension and volume of

contaminated sediments and gives a view of the sedimentological changes induced by industrial discharges. Moreover, the characterisation of the hydrographic, dynamical, geomorphological, sedimentological and geochemical conditions draws a detailed picture of the pre-industrial situation and of the comprehensive functioning of the bay, which are essential elements for planning the environmental restoration, which is one of the main focus of the ABBaCo Project.

Mapping of seabed morphology of the Bagnoli brownfield site, Pozzuoli (Napoli) Bay, Italy, by Di Martino et al. [2] provides a new and very detailed image of the seafloor morphology through a high-resolution bathymetric map and Digital Terrain Model (DTM) of the inner continental shelf offshore Bagnoli-Coroglio bay (Pozzuoli Bay, Gulf of Naples). The bathymetric maps provide a valuable tool for stakeholders towards a comprehensive planning and management addressed to environmental reevaluation and rehabilitation of this industrial area.

High-resolution seafloor sedimentological mapping: the case study of Bagnoli-Coroglio site, Gulf of Pozzuoli (Napoli), Italy, by Innangi et al. [3] presents a new high-resolution seafloor sedimentological map of Bagnoli-Coroglio bay based on the analysis of the acoustic backscatter, calibrated with grain size distribution of sampled surficial marine deposits.

Geological framework of the Bagnoli-Coroglio coastal zone and continental shelf, Pozzuoli (Napoli) Bay by Sacchi et al. [4] presents the reconstruction of the Latest Pleistocene-Holocene and Recent evolution of the Bagnoli-Coroglio coastal plain and continental shelf as an integral component of the active volcanic area of Campi Flegrei, through interpretation of Digital Terrain Model (DTM) and high-resolution seismic profile.

Vallefuoco et al. [5], in their paper **Shallow marine sediments characterization of the Bagnoli brownfield site, Pozzuoli Bay (Italy)**, use a combined geophysical-stratigraphic analysis to detect grain-sized anomalies in sediments distribution. They identified anomalous lens of silty sediments within a sandy coastal sector inside the Bagnoli harbour, likely connected to industrial discharges. They were able to define size and shape of the lens and to estimate the volume of the possibly polluted sediments to be in the order of 500,000 m³.

Sedimentological analysis of marine deposits off the Bagnoli-Coroglio Site of National Interest (SNI), Pozzuoli (Napoli) Bay by Molisso et al. [6] presents a sedimentological–mineralogical study providing a reconstruction of the environmental changes that have affected the offshore of the eastern Pozzuoli Bay. Thematic maps illustrate the areal distribution of the sedimentary facies at different stratigraphic levels, identifying changes likely related to the operation of the industrial site.

Current status of coastal sediments contamination in the former industrial area of Bagnoli-Coroglio (Naples, Italy) by Armiento et al. [7] defines the present status of contamination by heavy metals and organic substances. Both organic and inorganic pollutants show similar patterns in the areas, confirming their main industrial origin, although some heavy metals also derive from the geological setting of the area. The paper confirms that contamination is maximum in the area identified by the sedimentological and stratigraphic analysis. However, contamination is clearly detectable also in the outer study area, suggesting the need for a rapid remediation action.

Hydrographic and dynamical characterization of the Bagnoli-Coroglio Bay (Gulf of Naples, Tyrrhenian Sea) by Castagno et al. [8] provides an assessment of the physical and dynamical oceanography of the Coroglio-Bagnoli coastal area using hydrographic and current measurements collected during two different seasons and high-resolution regional ocean modelling. Physical data indicate a seasonal variability typical of the Southern Tyrrhenian Sea; current measurements, along with realistic ocean circulation modelling, show a predominant barotropic anticyclonic circulation over the bay during Autumn, which appears to be generated mainly by the local wind stress curl.

Characterization of beach run-up patterns in Bagnoli bay during ABBACO project by Di Luccio et al. [9] uses an integrated atmospheric and wave run-up forecasting system, validated with in situ measured data, to estimate the beach inundation height and distance in different locations along the coastal area of Bagnoli. The results obtained by the modelling chain, consisting of Weather Research and Forecasting model, Wave Watch 3 model and a run-up calculator, have provided useful information in order to support the design of the beach nourishment section in substitution of the 'Colmata a mare', an artificial structure limited by two piers and filled by scum, slag and landfill material.

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