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Benthic foraminifers and geochemistry of sediments from the central Adriatic coast, Italy: a multi-proxy environmental study

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Nowadays, it is of great interest to study and understand the sustainability of urban development, and the impact of human activities (agriculture, tourism, etc.) on coastal areas. During the last century, these regions have been deeply changed by human activities, which fostered modifications of the physical and chemical characteristics of the natural coastal environment, with important consequences on marine biodiversity. In approaching the study of environmental changes of a coastal area, benthic communities provide a fundamental tool because, due to a limited capacity of movement, they record temporal and spatial changes in the environment.

During the last 5 years, a series of campaigns has taken place along the central Adriatic coast (Marche Region, Italy), in the area between the rivers Foglia (Pesaro) and Musone (Numana,). This area is of particular geological and environmental interest because of the presence of protected areas (Monte San Bartolo and Monte Conero), and of strong urban development. Surface sediment samples have been recovered along several transects, which have been sampled on a seasonal basis. To understand the biological setting of the area, a detailed micropaleontological study of benthic foraminifer assemblages (faunal density and diversity, epi/infaunal ratio), and of their degree of malformation, along with geochemical analyses of the sediments have been performed.

The results of human activities have definitely an effect on the biocenosis of benthic foraminifera, mainly in terms of biodiversity, number of specimens and, last but not less important, morphologic anomalies. Faunal parameters vary seasonally depending on the overall quality of waters. Preliminary results have revealed frequent anomalies

in the morphology of foraminifera, whose distribution has no clear correlation with heavy metals distribution (Cr, Ni, Cu, Zn, Pb, and Hg) in the area.

However, heavy metals are not the only factors which may promote the degradation of the environment. In fact, despite its important role as a nutrient in all ecosystems, excess phosphorus may lead to changes in other nutrient cycles (e.g., nitrogen, carbon, and oxygen), alter the environment (e.g., eutrophication), and reduce water quality with important consequences for living organism. Indeed, the state of Adriatic Sea have become a serious concern in the last decades, due to its shallows depth and to incoming waters of the Po and other large rivers, which discharge considerable amounts of pollutants and nutrient, such as phosphorus. To clarify this aspect, we have performed phosphorus analysis of the samples investigated for benthic foraminifer associations from the winter 2005 sampling campaign.

Sedimentary phosphorus has been characterized following a sequential extraction technique, which allows the identification of 5 different sinks. Detrital phosphorus (non-reactive) represents the most abundant phase, while the other sinks represent up to 50% of total phosphorus. This phosphorus distribution is similar to the one observed at the FOAM site (Long Island Sound), where intermittently oxygenated sediments present relatively high porewater phosphate concentrations. Refining of the analysis will allow a better understanding of spatial changes in the physico-chemical characteristics of the coastal environment and the comparison with the microfaunal data.