PREFACE
OPHIOLITES AND ENVIRONMENTAL HAZARDS

Ophiolites (from the Greek words “ophis” = snake and “lithos” = rock) are fragments of the oceanic crust and the underlying mantle consisting of an assemblage of peridotites, gabbros, basalts and oceanic sediments. They represents fragments of oceanic lithosphere formed not only in the mid-oceanic ridge center but also in the back- and fore-arc basin. Regardless their geodynamic setting, the ophiolites provide valuable information about how the ocean crust develops. In addition, because no ocean crust is older than about 200 million years, the ophiolites represent the only source of information available about the oceanic crust prior to that time. Ophiolites are found throughout the world, including such places as Alaska, Argentina, the Balkans, California, China, Cyprus, Greece, Japan, New Guinea, Newfoundland, Oman, Taiwan, Tibet, and Turkey. In all these areas, the ophiolites occur as huge bodies enclosed into the collisional belts, with different variable deformation and metamorphic imprints.

However, the relevance of the ophiolites goes beyond their geodynamic meaning. The rocks belonging to the ophiolite sequences are exploited since long time, with the purpose of obtaining minerals and rocks for industrial use. Most of the ophiolites were widely exploited for as long as 5,000 years ago for asbestos production, before the discovery of its deep impact on human health. Directly associated with the ophiolites are the massive sulphides, copper and chromite mineral deposits. These ore deposits were formed in different stratigraphic units of the ophiolites and are exploited since stone Stone ageAge. In addition, ultramafic and mafic rocks from ophiolite sequences are the host for the major economic source of platinum group element (PGE) minerals. Currently, most of the ballast production derives from ophiolite bodies, like basalts and serpentinites. Finally, the ophiolites has a very significant role for the water budget because most of these rocks, especially the gabbros and the serpentinites, are good aquifers due their largeo fracturing.

Thus, owing their economic potential, the ophiolites are exploited commercially since long time and many human activities are related to these rocks.

These rocks, unmodified or modified by human activities, are ablecould to providecause different types of pollution, as . contamination of groundwater and sois by metals (mainly nickel and chromium) dissolved or inherited from ophiolite-related minerals, This pollution includes the contamination of groundwater by nickel and chromium or the airborne dispersion of asbestos fibers from the serpentinite rocks. up to the contamination of soils by metals inherited from ophiolite-related mineralizations. The ophiolite-related pollution from ophiolitic rocks is therefore a topic of particular relevance, mainly connected to the qualitative and quantitative modifications and use of environmental matrices such as air, soil, subsoil and groundwater. All these modifications have a considerable economic and social impact. In the last years, several procedures to determine the risk associated with to the presence of ophiolitic rocks as well as the procedures for their managing, safety and remediation have been proposed. This risk is particularly high when the ophiolitic rocks are affected by mining activities or excavation for roads and tunnels.

The current special issue provides 6 contributions related to recognition of the potential or effective pollution caused by rocks of the ophiolitic sequences.

The first paper by **Bianchini et al.** is devoted to high heavy metals backgroundsconcentration studies, in particular chromium and nickel, renowned well-know in soils and sediments of the Padanian plain (Italy). New XRF data, synthetized in georeferenced geochemical maps, are provided to emphasize the anomalously high Cr-Ni backgrounds of the fine alluvial sediments of the Po River. The collected data suggests that the observed geochemical features reflect the sedimentary components deriving from the weathering of femic and ultrafemic rocks. Extraction tests revealed that the chromium mobility of chromium is limited, but in contrast with the nickel, which on the other hand, displays a higher mobility. Coherently, the Cr/Ni ratio, is always higher than one in the investigated studied sediments and soils, is always >1, whereas is always lower than one<1 in both the natural waters and agricultural products of the area. Therefore, the potential high nickel concentration represents further geochemical risk of the area and the relative content has to be monitored in the local agricultural crops.

A veining sequence in the serpentinites from Pomaia quarry (Southern Tuscany, Italy) is described by **Donatio et al.**, in order to assess the textural occurrence of minerals belonging to asbestos group. In the Pomaia quarry a mantle section consisting of serpentinized peridotites belonging to the Internal Ligurian units is well exposed. All the structural, petrographic and mineralogical data, indicate that in the studied mantle a veining sequence of veins sequence developed as. This sequence includes: (1) veins filled by lizardite with blocky texture; (2) veins filled by chrysotile with both blocky and fibrous texture; and (3) veins filled by antigorite. This paper study provides for the first time the evidence that the serpentinization in of the Ligurian peridotite from the Internal Ligurian units is associated to a sequence of different events of veining, and . The presented data indicate suggest that the veining events developed in response to a history dominated by alternance of tectonic-controlled and magmatic-controlled hydration of the peridotites in a slow-spreading ridge setting.

Gaggero et al. tested a protocol that aimed to improve the Italian DM 16/5/1994 Release Index, concerning the asbestos risk related to peridotite serpentinite quarrying. The resultsir of pilot studies, using based on microstructural and mineralogical investigations to assess the distribution and approximate volumes of asbestos minerals and their potential contribution of airborne fibres, were undertaken at six quarry sites within the very-low-grade metamorphic ophiolites of the Northern Apennines in eastern Eastern Liguria, (Italy) are provided in this paper. An improvement of the Italian DM 16/5/1994 Release Index is proposed by addressing the issue of multi-scale analyses that are tailored for studies from outcrop scales to the microscale by integrating multiple techniques (optical microscopy, scanning electron microscopy, XR diffractometry, μ-Raman, geomechanical analysis, and modal petrographic analyses).

Langone et al. report on the release of Cr(VI) to water from geogenic sources. Spring waters, soils and bedrocks compositions within two serpentinised serpentinite-dominated bodies areas of the coastal Tuscany (Italy), namely Santa Luce and Querceto, are examined. These selected sites are characterised by Cr(VI)-free and Cr(VI)-bearing spring waters, respectively. The prevalence of Mg-HCO_3 waters at these sites indicates that waters are primarily interacting with serpentinites. Soil profiles and bedrocks were analysed. Detailed petrographic and chemical analyses of both soil and rock samples revealed that Cr is mainly hosted within chromites, partially altered to Mn- and Fe-rich oxides. Chemical data and alteration features indicate a metasomatism coeval to the oceanic serpentinization leading to an Mn-enrichment of the alteration product of primary spinel. The co-occurrence of Mn- and Fe-rich oxides Mn-bearing and Fe-rich oxides with Cr-rich spinels creates a chemical system potentially able to promote the Cr(III) to Cr(VI) oxidation. However, the occurrence of Mn-rich minerals seems to be not correlated to the oxidation state of chromium in the spring waters.

Laterza and Franceschini have analyzed the concentrations of Cr and Ni and other heavy metals (Cd, Cu, Pb, Zn) in stream sediments collected into the Cecina river basin (Tuscany, Italy) in order to evaluate Cr and Ni levels and their spatial distribution and origin. The presented data indicate the occurrence of high levels of Cr and Ni in the stream sediments, often exceeding the thresholds of the Italian law currently in force (Legislative Decree No. 152/2006). Multivariate data analysis techniques (HCA) were used to obtain information about the potential sources of heavy metals. The results indicate an Cr- and Ni- enrichment in stream sediments due to the presence of some extensive outcrops of serpentinites.

Zaccagnini and Marroni propose a new integrated approach in order to define the hazard induced by airborne dispersal of asbestos fibersfibres during the serpentinites quarrying. The adopted approach consists of 5 successive steps: (1) detailed structural mapping,; (2) petrographical study of selected thin sections of serpentinites;, (3) X-Ray powder Diffraction analyses;, (4) determination of the Index of Release according to the Ministerial Decree 14/05/1996; and (5) modelling of the airborne dispersion of asbestos fibers by the quarrying activity. This approach has been simulated for an area west of Pievescola, south of Casole d'Elsa, Tuscany (Italy). The implications of the adopted approach are discussed in order to identify valuable procedures to minimize the asbestos-related hazard.

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