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Editorial

Editorial for the Special Issue "Bio-Geochemistry of Heavy Metals/Metalloids"

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This Special Issue "Bio-Geochemistry of Heavy Metals/Metalloids" contains a series of papers that cover a range of topics highlighting the role of microorganisms in ore-forming biochemical processes and potential environmental risk (the first to fourth papers), in the assessment of potentially toxic element contamination using plants and living benthic Foraminifera (the fifth and sixth papers), and in the phytoremediation of contaminated land (the seventh paper). The topic of the first paper, by Economou-Eliopoulos et al. [1], is the biogeochemical redox processes controlling the element cycling in karst-type bauxites in the Mediterranean metallogenetic province and the natural beneficiation (increase in the Al_2O_3 content) of the bauxite ore quality. A salient feature of the multicolor ores (grey-whitish, yellowish, deep red, deep grey to brown-red color) from Greece is their association with fossilized and present-day microorganisms that catalyze redox reactions by their reducing and/or oxidizing activity; they provide nucleation sites for the precipitation of secondary minerals, such as the reduction of iron to Fe(II), and facilitate its migration and the precipitation of framboidal pyrite as veins crosscutting previous phases. The geochemical characteristics of bauxite ores and smelting residues and their water leachates suggest that the cycling of metals and metalloids during the open-pit mining of bauxite and the large volume of red mud may cause changes to the land use, ecosystems, and food quality. The second paper, by Eliopoulos et al. [2], on the cycling of Pt, Pd, and Rh derived from catalytic converters addresses the dispersed Pt- and Pd-bearing nano- and microparticles in dust and soil along highways of the Athens Basin. The determined mean values of 310 Pt, 510 Pd, and 23 Rh (all in μg/kg) in the dust samples are much lower than the 2070 μg/kg Pt and 1980 μg/kg Pd content in gully pots, and higher than the mean values of 230 Pt, 300 Pd, and 13 Rh (all in μg/kg) in the soil samples. Although the Pt, Pd, and Rh bio-accumulation factors for shoots of plants/crops are relatively low, the increasing number of cars with catalytic converters in Greece and the relatively high bio-accumulation in the food chain may highlight a potential risk for human health and ecosystems, and the need for special attention on their bio-accumulation and bio-accessibility on a global scale. The third paper, by Vasilatos et al. [3], on bio-geochemical evidence from Fe-Mn mineralization in the Aegean Sea (Greece) provides a compilation of new and existing mineralogical and geochemical data on Fe-Mn mineralization from the Aegean region, including Attica (Grammatiko, Legrena, and Varnavas), Evia, and Milos island, and provides new insights on the genesis of Fe-Mn mineralization in that region. The bacterio-morphic Fe-Mn-oxides/hydroxides within Mn-Fe mineralization are a common feature within Mn-Fe deposits in the areas of Varnavas and Milos Island, and in Fe-Mn deposits in the Legrena Valley (Lavrion), which may reflect the catalytic role of microorganisms in redox reactions that govern the formation of these Mn-Fe and Fe-Mn mineral phases. The fourth paper, by Kanellopoulos et al. [4], is on the bio-mineralization processes related to microbial mat stratification in travertine depositions in extreme environments (hot springs in the Aedipsos/Euboea Island, Greece). Among the identified Cyanobacteria are typical thermophilic and limestone substrate species, filamentous Cyanobacteria and diatoms, extracellular polymeric substances (EPS) creating crystal retention lattices, contributing to the biomineralization

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process, and filamentous sheaths of Cyanobacteria, resulting in the creation of calcium carbonate tubes. The response of living benthic Foraminifera in the Saronikos Gulf (Greece, Eastern Mediterranean) was investigated by Dimiza et al. in the fifth paper [5]. The Saronikos environment is characterized by relatively high heavy metal content and pollution due to industrial activities. The benthic foraminifera were used as reliable indicators for the determination of the natural environmental and anthropogenic impact in the shallow coastal systems of Elefsis. Specifically, the living benthic foraminifera composition and their relation to environmental parameters such as grain size, organic carbon, and metal contents was investigated, and a negative environmental impact caused by the relatively elevated organic carbon and heavy metal (Cu, Pb, Zn) contents was demonstrated. The sixth paper, by Zafeiriou et al. [6], is an assessment of potentially toxic element contamination in a peatland basin in Eastern Macedonia (Greece), which is considered the biggest peat deposit in the Balkan Peninsula and one of the deepest in the world. The environmental risk was evaluated based on the determined contents of potentially toxic elements (PTEs), such as As, Se, Pb, Cr, Ni, Zn, Mn, and Cu, in corn grains and corresponding soil samples in the peatland, and the calculated pollution indices. The higher bio-accumulation factor (BF) for Cu, Zn, and Se indicated increased mobility of these elements in the soils and preferential plant uptake. For most soil samples, the geo-accumulation index (Igeo) and single pollution index (PI) showed low to moderate contamination. According to potential ecological risk (RI), the PTE content in the peat soils of Philippi poses a low to moderate risk to the environment. In their study (the seventh paper), Żołnowski and Wyszkowski [7] applied phytoremediation by using neutralizing additives in order to improve the soil properties in land highly contaminated with copper. Copper contamination significantly decreased the soil pH and increased its hydrolytic acidity (HAC). These authors concluded that among the additives, limestone had the most beneficial effect on reducing soil acidity, contributing to a significant increase in total exchangeable bases (TEB), cation exchange capacity (CEC), and base saturation (BS).

Conflicts of Interest: The authors declare no conflict of interest.

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