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Editorial

Nanomineral and Their Importance on the Earth and Human Health: A Real Impact

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Naturally, nanominerals and amorphous nanoparticles have a crucial influence on the Earth and human health. On the other hand, these ecological factors are connected to accumulating water contamination, emerging pollutants in nature, greenhouse gas production, and toxic effects of fuels and chemicals, and all of these are of utmost importance for ecological defense. This Special Issue (SI) on environmental research provides an overview of nanoscience-based environmental applications and discoveries concerning mineral mining, refining/production, and disposal of mining wastes; atmospheric changes; soil health; general contaminant remediation strategies; and sediment influences on water quality. These processes result in extensive nanoparticle generation, which has highly significant environmental implications and human health consequences on local, regional, and even global levels. Until recently, very little was known about nanoparticle fractions. Recent advancements have enabled us to detect, collect and study these materials, which range from roughly one nanometer (0.001 microns) to several tens of nanometers in size. These materials are known to behave differently (chemically, electrically, and mechanically), relative to their macroscopic equivalents. This is what makes nanoscience fascinating and difficult to predict, underscoring the importance of this emerging field. This incorporates extensive and distant transportation downstream, and finally to seas, especially in the case of mine drainages. In terms of human health, in all phases of mining, production/refining, use, and waste disposal, the associated nanoparticles can be acquired through oral ingestion, inhalation, and dermal absorption. There is also a current gap in what we so far know about the behavior of nanoparticles, and what remains to be determined. In addition, eco-friendly and green nano-science holds abundant promise to solve large-scale challenges, offering results to these complications in the form of preventive and remedial tools to diminish contaminants from the ecosystem. These original research papers, short communications, and review papers present a significant contribution to the current nano-geoscience literature.

A more detailed assessment of particles that contain rare-earth elements (REEs) in abandoned deposits of Brazilian fine coal tailings (BFCTs) was carried out to aid the current coal mining industries in the identification of methodologies for extracting such elements (Santa Catarina State, Brazil and Colombia) [1,2]. The BFCT areas were sampled for traditional mineralogical analysis by X-ray diffraction, Raman spectroscopy and nanomineralogy by a dual beam focused ion beam (FIB) coupled with field emission scanning electron microscopy (FE-SEM) and high-resolution transmission electron microscopy (HR-TEM) coupled with an energy dispersive X-ray microanalysis system (EDS). The results show that the smaller the sampled coal fines were, the higher the proportion of rare-earth elements they contained [1]. Although the concentration of REEs is below what would normally be considered an economic grade, the fact that these deposits are already ground and close to the surface negates the need for mining (only uncovering). This makes it significantly easier for REEs to be extracted. In addition, owing to their proximity to roads and rail

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transport in the regions under study [2], the opportunity exists for such resources (BFCTs) to be utilized as a secondary market as opposed to simply being discarded, which has been the case in the past [3]. Particulates in the nanoparticle and ultra-fine particle range are being released from uncontrolled coal fires and may be impacting the environment and the health of the mine workers and nearby residents, an issue that should be investigated [3].

On the other hand, port/naval terminals are being called upon to increase the sustainability of their operations to better fit with the environmental dynamics of their locations [4,5]. Within this context, the Palermo Sociedad Portuaria (PSP) has taken a proactive stance in identifying the factors contributing to its CO_2 emissions. This study evaluated the CO_2 emissions of the PSP in 2019 and 2020 and, through the implementation of sustainable practices (rock dust spreading, composting and reducing the burning of fossil fuels), examined the mitigation of the port's carbon footprint (CF) in the year 2022. Based on collaborative management results and efforts, a set of viable mitigation strategies adapted to port operations was formulated. Viability was assessed through monitoring of the practical implementations encompassing initiatives such as fuel reduction, waste composting and the application of rock dust. The introduction of the CARE system in the operational equipment led to a reduction in fuel consumption over five periods—amounting to an overall emission decrease of 1629 metric tons of CO_2 equivalent (ton CO_2 eq). Meanwhile, the strategic composting of waste generated by port activities (including organic waste, hand towels, coffee grounds and landscaping waste) resulted in the potential reduction of 2 metric tons of CO_2 annually. The application of rock dust (10 kg m^{-2}) in the available green spaces within the operational areas contributed to a decrease of 0.00080543 ton CO_2 eq over 45 days. The implementation of these three key measures over the course of a year has the potential to prevent the release of 37 ton CO_2 eq, signifying a 2% decrease in overall CF when compared to the base year of 2020. This investigation was rooted in the current operational reality of the port terminal and its correlated activities. The strategies deployed underscore the feasibility of low-cost solutions that can be emulated across port terminals in the pursuit of the holistic aspirations encapsulated in the concepts of a "green port" and a "smart port" [6], for example by using bioadsorbent material [7].

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