The asbestos extraction in the Balangero mine: Environmental consequences

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The Balangero mine is situated near Turin (Italy). This area has been identified as National Interest site for remediation by the Law. 426/98. It includes a mountainous region about 400 ha; a former industrial plant of about 40.000 m^2; a lake of approximately 2 million m^3, caused by rainwater; dumps of the stone material. The mine produced chrysotile from the 1920s and in the 1970s became the largest asbestos mine in Europe. The current configuration of the mine was determined, over the years, by the different techniques of mining. The first mining activity took place with the "Glory-Hole". Only 2% of asbestos was recovered and the remaining tons of rock were dumped on a wide area without any safety measures. In 1958 the technique of extraction was replaced by mechanized cultivation, causing a considerable movement of rock that was dumped in the territory, contaminating the area (air, water and soil) of the Municipality of Corio and Balangero. The mine took the current form of half-amphitheatre. In 1990 the mine was closed, although there were still over 18 million tons of asbestos to extract. The mine wasn't reopened because the D.L. 92/257 banned the extraction, import, export, marketing and production of asbestos, its products and products containing asbestos. As is well known the release of pollutants, as asbestos, in the environment causes extremely negative consequences to human health and environment. The projects and the resulting activities from the recovery of Balangero mine involve complex issues of risk management related to instability of some of the areas subject to intervention and handling of large quantities of asbestos materials, including a potential health risk for the population exposed. The remediation activities require a constant monitoring of environmental conditions of sites and the surrounding areas. The aim of this monitoring is to control and to prevent the risks to the population and to ensure the safety of workers engaged in the remediation activities. Interventions were made over the area, emergency situations and, more generally, a monitoring campaign was organized, capable of providing data to manage the risk. In this stage, the priority concern is dedicated to the removal of abandoned production area structures, the interventions for the hydro-geological stabilization of the landfills, removal of contaminated sludge and hydro-geological works aimed at controlling rainwater. In this paper, describing the different phases of remediation works in such a great plant, it is possible to focalized the milestones of the procedures and the importance of a stringent monitoring activities.

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Chemical fractionation after the moon-forming giant impact

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Among the earliest observations made of the Apollo samples was the chemical similarity of lunar and terrestrial basalts. Closer scrutiny has revealed significant chemical differences between silicate Earth and Moon [1], despite a remarkable degree of isotopic homogeneity [2]. In the context of the giant impact hypothesis [3], a high level of homogeneity can be achieved if the post-impact Earth equilibrates with the surrounding proto-lunar disk through turbulence while the system is molten and partially vaporized [4]. Without liquid-vapor separation, such a scenario leads to a lunar composition isochemical with the terrestrial mantle. Hence, the equilibration scenario raises the question of how *chemical* differences between silicate Earth and Moon arose. Among these differences are the higher Fe/Mg ratio, volatile element depletion [1] and possible enhancement of refractory elements in the bulk Moon relative to Earth mantle [5].

Here, we explore the consequences of liquid-vapor fractionation in the aftermath of the giant impact. We show that chemical differences between the Earth and proto-lunar disk can arise through liquid-vapor separation, even as isotopic heterogeneity is eliminated via turbulent mixing. We consider a two-stage model in an attempt to derive the lunar composition from the partially-vaporized terrestrial mantle through magmatic differentiation. In the first stage, rain-out of liquid droplets in the silicate vapor atmosphere of Earth enriches the Fe/Mg ratio of ascending parcels. In the second stage, which occurs in the proto-lunar disk, parcels undergo partial condensation [5], with the precipitating liquid depleted in volatile elements and considered the candidate lunar-forming material. Finally, we make predictions for isotopic measurements that can test such a scenario experimentally.

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