



The effect of gold mining and processing on biogeochemical cycles in Muteh area, Isfahan province, Iran

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The environmental impacts of gold mining and processing on geochemical and biogeochemical cycles in Muteh region located northwest of Esfahan province and northeast of Golpaygan city is investigated. For this purpose systematic sampling was carried out in, rock, soil, water, and sediment environments along with plant, livestock and human hair samples. Mineralogical and Petrological studies show that ore mineral such as pyrite and arsenopyrite along with fluorine-bearing minerals like tremolite, actinolite, biotite and muscovite occur in green schist, amphibolite and lucogranitic rocks in the area. The hydrochemistry of the analysed water samples indicate that As and F display the highest concentrations among the analysed elements. Indeed arsenic has the highest concentration in both topsoil and subsoil samples when compared with other potentially toxic elements. Anthropogenic activity also have it s greatest effect on increasing arsenic concentration among the analysed samples. The concentration of the majority of the analysed elements in the shoots and leaves of two local plants of the region i.e Artemesia and Penagum is higher than their concentration in the roots. Generally speaking, Artemesia has a greater tendency for bioaccumulating heavy metals. The results of cyanide analysis in soil samples show that cyanide concentration in the soils near the newly built tailing dam is much higher than that in the vicinity of the old tailing dam. The high concentration of fluorine in the drinking water of the Muteh village is the main reason of the observed dental fluorosis symptoms seen in the inhabitants. One of the two drinking water wells which is located near the metamorphic complex and supplies part of the tap water in the village, probably has the greatest impact in this regard. A decreasing trend in fluorine concentration is illustrated with increasing distance from the metamorphic complex. Measurements of As concentration in human hair specimens indicate that As content in all analysed samples is higher than the published standard levels. The most probable source for As contamination is the high concentration of this element in tap water and nutrients in all trophic levels. As content was also found to be high in livestock's wool and hair. Arsenic toxicity is probably the main reason for the observed hyperpigmentation and keratosis of palms and soles seen in the villagers. The high concentration of arsenic in various biogeochemical cycles in the Muteh region is the result of the geological nature of the Muteh district enhanced by gold mining and processing which plays an active role in the remobilization of this elements.