

POLLUTANTS TRANSFER FROM SOIL TO WATER: GEOCHEMICAL INVESTIGATION IN DIFFERENT WATERSHEDS

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Despite policies for sustainable management of watersheds and groundwater quality, a general decline of water quality is being observed, especially due to the human impact on the environment. In Italy over 130000 tons of phytosanitary products are used every year in the agriculture, thus increasing the pollution risk both in soils and in the waters.

In this study, a comparison between two areas in the Marche region, very different from a geological, pedological and hydrological points of view, has been performed with the objective to identify and study the transfer mechanism of pollutants from the pollution source, through the soil matrix to the surface and ground waters (Tazioli et al., 2015; De Bernardi, 2017).

The first area is characterized by a high human impact, in terms of agriculture activities, industries and urban settlements; the geology of the area is given by alluvial plains, sands and clays of the Plio-Pleistocene and sandstone of the Pliocene. The second area is more natural, but small crops (as alfalfa and cilantro) are cultivated in certain zones of the watershed. The geology is quite different, with the outcrops of the Umbria-Marche limestone ridge at the center of the basin (Scaglia rossa, Scaglia cinerea Fms.) and a less extended alluvial plain.

Periodic sampling of soils, surface water and groundwater were performed in the investigated period (March-July 2016), and chemical (F⁻, Cl⁻, Br⁻, NO₃⁻, HPO₄²⁻, SO₄²⁻, Ca²⁺, Na⁺, pesticide, organic and biomass carbon, FDA, Ni) and isotopic (²H and ¹⁸O in water samples) contents were determined in each sample. Soil sampling were performed by means of a hand auger, the samples put into a sealed bag and stored at 4 °C until the analyses. Water sampling were performed by means of manual sampler and glass bottles.

All the samples were collected in the spring/summer period, when the crops were in active form.

The chemistry of water soil was compared to that of surface and groundwater in the areas, allowing for the identification of the pollutants transfer mechanism; these results indicated also some differences in the two study sites, related to the difference in land use, geology and hydrological behavior. Chemical contents of Nichel were high in both the investigated sites (up to 31 mg/l), also in the more natural one, depending on the mineralization of water by rocks and soils. The isotopes, compared to the isotopic content in precipitation, confirmed the supposed mechanism of pollutants transfer and helped in the aquifers and rivers recharge identification. In particular, a mean value of about -6.8‰ VSMOW in the first area and -7.7‰ VSMOW in the second area was determined for the oxygen-18.

Further investigations are in progress in the areas to better detect and validate the proposed mechanism.

References

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