Geochemical mass balance of major chemical constituents and some aspects of trace element geochemistry in groundwater of Patancheru Industrial Area, Andhra Pradesh, India

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Patancheru Industrial Development Area located about 40 km from Hyderabad, is one of the 13 industrial development areas, which have been developed by the Andhra Pradesh State Government. There is a Common Effluent Treatment Plant (CETP), located in the area to treat the effluents released form the industries to check toxic metals concentrations. The study area is identified as one of the contaminated sites by the Central Pollution Control Board, New Delhi and frequently referred to as an area of ecological disaster. Around 200 small and large-scale industries are established in this area, which mainly deal with pharmaceuticals, paints, pesticides and chemicals apart from steel and metallic products. Many small streams drain through the area to join the main Nakkavagu stream, which joins Manjira River, a drinking source to some parts of the Hyderabad city.

Groundwater samples collected from open and drilled wells during pre- and post-monsoon, in and around Patancheru Industrial Area, were analyzed for major, minor and trace constituents. The analytical data were used to classify the groundwater and to deduce its chemical characteristics/quality. Mass balance calculations on major chemical constituents were performed to infer the dominant chemical weathering reaction and to quantify the rate of chemical denudation. Heavy and toxic trace elements (As, Pb, Cr. Co, Ni, Cu, Cd, Zn,) were estimated by ICP-MS to assess the extent of pollution and its impact on human health. Contour maps for these trace elements were prepared for both pre- and post-monsoon to know their spatial and temporal distribution, and to identify the point source and transport of the contaminant.

Detailed prospecting of As-low sources in southeastern France

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Beside well-known and wide areas affected by high-As aquifers in sediments, arsenic contamination may also affect other types of geological environments as some mountainous regions over the word. In these cases, metamorphic rocks, often forming the dominant geological formations of old massives, may be a source of arsenic. Because of the scattered housing environment prevailing in the valleys, adapted low-cost and sustainable solutions must be proposed to resolve the problems of high-As content in drinking water and in water used for mountains breeding.

A detailed geochemical study is performed in the Mercantour Massif in southeastern France. In several rural districts, drinking water exceeds the european limit of 10 µg/l. This water is one component of the main source of drinking water for more than 600 000 inhabitants of the Côte d'Azur, in the lower part of the Var river catchment. Here, both dilution effects and adsorption of As in the alluvial nappe conduce to water of good quality.

As-contaminated waters occur in two main geological formations: Hercynian metamorphic rocks and Permian pelites. Water/rock interactions are especially investigated to help discovering unknown low-As sources. This study shows that (1) As content in rocks is highly variable, mostly from 1 to 90 mg/kg, without showing any apparent relationship between As content and rock facies, and (2) in restricted areas, where the geological formations are apparently homogeneous, high variations of As content in water (from 0.2 to 260 µg/l) are observed.

First conclusions of this study are the following. (1) Arsenic contamination of groundwater in these metamorphic formations may be the result of either heterogeneous As concentrations in rocks and/or circulation of water in faulting zones affected by As-rich ore deposits. (2) In mountainous regions where high-As problems have not been yet investigated in details (which is still the case even in developed countries), the high variability of As in water allows to find low-cost sustainable solutions by performing a detailed prospecting of water sources at the vicinity of each village. (3) When possible, such a solution avoids expensive treatment units that produce As-rich wastes.