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GIS-Based Spatial Distribution and Evaluation of Selected Heavy Metals Contamination in Topsoil around Ecton Mining Area, Derbyshire, UK

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Abstract : The study area (Ecton mining area) is located in the southern part of the Peak District in Derbyshire, England. It is bounded by the River Manifold from the west. This area has been mined for a long period. As a result, huge amounts of potentially toxic metals were released into the surrounding area and are most likely to be a significant source of heavy metal contamination to the local soil, water and vegetation. In order to appraise the potential heavy metal pollution in this area, 37 topsoil samples (5-20 cm depth) were collected and analysed for their total content of Cu, Pb, Zn, Mn, Cr, Ni and V using ICP (Inductively Coupled Plasma) optical emission spectroscopy. Multivariate Geospatial analyses using the GIS technique were utilised to draw geochemical maps of the metals of interest over the study area. A few hotspot points, areas of elevated concentrations of metals, were specified, which are presumed to be the results of anthropogenic activities. In addition, the soil’s environmental quality was evaluated by calculating the Mullers’ Geoaccumulation index (I geo), which suggests that the degree of contamination of the investigated heavy metals has the following trend: Pb > Zn > Cu > Mn > Ni = Cr = V. Furthermore, the potential ecological risk, using the enrichment factor (EF), was also specified. On the basis of the calculated amount or the EF, the levels of pollution for the studied metals in the study area have the following order: Pb>Zn>Cu>Cr>V>Ni>Mn.

Keywords : enrichment factor, geoaccumulation index, GIS, heavy metals, multivariate analysis
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