Hydrogeochemistry, groundwater quality and pollution potential studies of Satna City, Madhya Pradesh, India

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Hydrogeochemical investigations were carried out in Satna City (Latitude 230 58' : 240 30'N, Longitude 80 0 21' : 81 0 23') Madhya Pradesh, India. In the study area, Limestones of Bhander Group, Vindhyan Supergroup (Neoproterozoic) are exposed. A total of 30 groundwater samples were collected during Post-monsoon season of 2010 and subjected to analysis for chemical characteristics. The main hydrochemical facies are Ca-Mg-HCO_3 and Ca-Mg-SO_4 –cl types. As per classification, most of the samples are normal chloride, normal carbonate, moderate to very hard in nature. The concentration of sulphate was higher due to gypsum bands associated with shale formation. In few samples concentration of fluoride exceeds maximum permissible limit (>1.5 mg/l) due to fluorite bearing mineral associated with aquifer. The concentration of nitrate in groundwater samples of the area is also exceeded beyond the permissible limit of 45mg/l. The consumption of water having nitrate concentration in excess of 100 mg/l may reduce the oxygen carrying capacity of the blood, particularly in infants causing infantile methemoglobinaemia. The analytical results reveal that most of the samples containing high nitrate also have high chloride and potash. In the absence of a possible geogenic source of chloride in the area, application of nitrogen rich fertilizer seem to be possible source. The comparison of analysed data with WHO (1984) and ISI (1991) indicate that groundwater samples of the area are more or less suitable for drinking.

Besides these, pollution potential has been estimated by DRASTIC modeling which suggests that the area is highly susceptible to pollution. A proper attention and water quality programme is needed to check the groundwater pollution.

EBSD Study of Lattice Preferred Orientation (LPO) of the harzburgite NWA 5480

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Classified as belonging to the Howardite-Eucrite-Diogenite (HED) group of achondrites, the olivine-rich diogenite Northwest Africa 5480 is thought to represent an ultramafic cumulate formed within a magma chamber in the upper mantle of the differentiated asteroid 4 Vesta, or a Vesta-like body [1]. Dominated by olivine (57 vol%) and orthopyroxene (42 vol%) NWA 5480 has further been classified a harzburgite [2], whereby the distribution of olivine and orthopyroxene is very heterogeneous, with some areas displaying up to 90% of either of the two minerals. In this study, structural analysis was performed on the olivine grains of NWA 5480 using electron backscatter diffraction (EBSD), which allows us to measure and visualize the crystallographic orientation of the crystal axes to discover any lattice preferred orientation (LPO) [3]. The sample was categorized into two regions for targeted analysis: (a) Zone A, dominated by coarse-grained olivine, and (b) Zone B, dominated by orthopyroxene-olivine schlieren. A total of 1361 EBSD crystallographic orientation measurements of coarse-grained olivine were recorded from 58 sites (each site covering 1 mm2) within Zone A and a total of 148 measurements of finer-grained olivine were recorded from 20 sites within Zone B. Only EBSD measurements with a mean angular deviation (MAD) of <1 were accepted and recorded. The EBSD results of Zones A and B display pronounced yet distinctly differing LPOs, suggesting two separate deformation processes and/or events. A comparison with olivine LPO in terrestrial cumulates and deformed mantle peridotites illustrates the unlikeliness that the olivine LPO from Zone A of NWA 5480 was formed through cumulation or compaction processes. In contrast, a distinct similarity to the olivine LPO formed by pencil glide ((0kl)[100] glide system), typical of plastic deformation in the terrestrial mantle, causes us to consider alternative formation processes for NWA 5480, including the feasibility of convection within the Vestan mantle.

[1] McSween Jr. H. (2010) *Space Sci Rev* DOI 10.1007/s11214-010-9637-z. [2] Beck, A. & McSween, H.Y. Jr. (2010) *Meteoritics & Planetary Science* **45**, 850–872. [3] Prior, D. *et al*. (1999) *Amercian Mineralogist* **84**, 1741–1759.