## ABSTRACT

Close examination of the oxidized profile of the ore-bearing horizon at Chapri (in the central sector of the Singhbhum Copper Belt) reveals several unusual features. These include : only partial leaching of copper, even from the cap-rocks; in-situ transformation of copper sulphide minerals into oxidized compounds; retention of substantial amount of copper by supergene clay minerals; virtual absence of any supergene sulphide immediately below; and non-congruence between the bottom of the oxidized zone and the present water-table.

Petrological studies of systematic drill core samples and in-situ measurements of Eh-pH values of surface and mine water provide explanations for such unusual features. The mode of occurrence of the primary ore (as sheeted-veins and disseminations), with its low pyrite content, accounts for localized generation of strong acids that were quickly neutralized by extensive hydrolysis reactions in the host-rock, manifest in an upper kaolinitic zone and an underlying illite-chlorite rich zone in the weathered profile. Such neutralization inhibited any significant migration of copper —— outwards or downwards —— by precipitating the oxidized copper compounds: also, availability of cupriferous solution during neoformation of supergene clay minerals led to fixation of some copper to the clay mineral lattices. Thus, virtually no copper-bearing solution was available for supergene sulphide enrichment. Vertical zoning of copper minerals elegantly matches the Eh-pH stability diagrams and is consistent with the measured Eh-pH values. The bottom of the oxidized zone is interpreted as a palaeo water-table, somewhat tilted in sub-recent times.

Leaching experiments conducted with the bulk-rocks and their clay fractions indicate that a 24-hour leaching period with 5% $H_2SO_4$ represents the optimum condition. The experiments also provide an insight into the mechanisms of fixation of copper to different clay minerals and suggest a new possibility of exploitation of copper from the oxidized zone through open-cast mining followed by acid-leaching.