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Geochemical evolution of polygenic ferricrete-capped landscapes: Example from the Poura region, Burkina Faso

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The geochemistry and petrography of stepped ferricrete-capped erosion levels (pediments) were studied along the Ton and the Balabo topographic sequences in the Poura area, Western Burkina Faso. Geochemistry of the ferricretes, which formed by several successive depositional-erosive cycles, indicates that their composition is a function of their elevation with respect to the local river level.

Increasing contents of Si and decreasing contents of Fe, Ti, Pb, Cr, and Rb were found to correlate with decreasing altitude, i.e. from the oldest, uppermost ferricrete level to the lowest one. Arsenic contents were found to decrease with decreasing altitude, which is explained by the decreasing content of iron oxi-hydroxides that are the main arsenic sorbents in the ferricretes. The spatial distribution of gold is very irregular, and no correlation is observed between gold content and altitude. The correlation of other major elements (Ca, K, Al, Mn, Ba) concentration with elevation of the ferricrete levels is not clear. The increase in Si and correlated with decrease in the amount in Fe and other elements such as Ti, Pb, Cr, Rb and As from the uppermost to the lowermost ferricrete level is interpreted as resulting from intensification of regolith stripping from the higher to the lower levels, which led to an increasing exposure of autochthonous saprolite and saprock i.e., rocks the richest in detrital quartz.

The uppermost ferricretes formed at an altitude of 312-305 m (a.s.l.) mostly consist of a mixture of clay minerals, hematite and chalcedony, while quartz exceptionally occurs in the form of small (4,82 Si wt%), highly corroded relics enclosed in iron- and alumina-rich matrix. Detrital quartz grains first appear in the hematite/goethite-rich matrix of nodular ferricretes forming the 290-265 m high erosion level (5.23 Si wt%). In ferricretes capping the 263-240 m high erosion level, abundant quartz aggregates or quartz grains (5.73 Si wt%) occur in the matrix or form part of polymict, hematite-, goethite- and chalcedony-rich nodules. This is indicative of repeated detrital reworking of quartz grains, which ultimately become free in the lowermost level at 239-238 m elevation (7.96 Si wt%).