GEOCHEMICAL EVOLUTION AND DEGENERATION OF FERRICRETES UNDER A HUMID TROPICAL CLIMATE IN THE EAST OF CENTRAL AFRICAN REPUBLIC

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In the Dembia-Zemio region of the Central African Republic, a detailed petrographical, geochemical and cartographical study of ferricrete profiles developed on presumed basic parent-rock showed that the distribution and evolution of the succession of the weathering layers are a function of their situation in the landscape, and of the actual and past pedobioclimatic conditions.

The most evolved, oldest massive ferricretes have developed and are still well preserved only on high parts of the landscape, where they are associated with advanced ferruginisation of thick kaolinitic isalteritic lithomarge. This layer is kaolinitic at his base and gibbsitic at his top, with a mean percentage of goethite. Massive ferricrete is the most ferruginous and the richest in hematite, and it caps a thick weathering profile characterized by a thick soft nodular layer.

The least evolved youngest vacuolar ferricretes have developed and are still well preserved only on low parts of landscape, where they are overlying thin weathering profile characterized by a thick soft ferricrete layer and an isalteritic lithomarge which is made of kaolinite and some relicts of parent-minerals, quartz and micas. Vacuolar ferricrete is the least ferruginous and the richest in goethite and kaolinite with preserved quartz.

Locally, massive ferricretes are degenerated and dismantled in the areas covered by forest where hydration and high organic mater content take place either at the top of the profile or within the ferricrete layer, when the water table is close to the soil surface. Thus, pH becomes more acid, weathering conditions are more reducing. Therefore, iron is released and transfered from the dismantling area at the top to the bottom of the ferricrete profile, and a new ferricrete develops above the water table.

This secondary youngest ferricrete is richer in goethite and less evolved than the primary massive ferricrete. Moreover, in a petrographical and a geochemical point of view, it looks like some ferricretes which are developed on slopes or low parts of landscape. Therefore, these latters have generated too from the geochemical dismantling of an early massive ferricrete under changing in morphoclimatic conditions, which have involved the erosion of surfaces and the subsidence of the lateritic landscape.

The most goethitic and gibbsitic ferricretes are less evolved than the hematitic massive ferricrete, and they have developed on slopes and low parts of landscape. Thus, the geochemical dismantling of oldest massive ferricrete under morphoclimatic change involve the mineralogical transformation of hematite in goethite and kaolinite in gibbsite.

In average and at the profile scale, ferricretes are not clearly differentiated in a geochemical point of view. On the other hand, isalteritic lithomarges are better differentiated. For instance, lithomarge of high parts of landscape are the most ferruginous, the richest in goethite and transitions chemical elements, Mn, V, Ni, Co, Cr, Zn and Cu, whereas lithomarge of low parts of landscape is depleted of iron and rather enriched in earth alkalis, Ba and Sr, and rare earth elements, La, Ce, Y and Yb.

In average and at the regional scale : massive ferricretes with high Fe, hematite and kaolinite contents are also enriched in trace elements, Sr, La, V and Zr ; on slopes, pseudonodular ferricretes with highest gibbsite and quartz contents are less evolved, and rather enriched in more mobile chemical elements, Ba, Nb, Ce, P, Mn, Co and Ni, which are immobilized in the weathering profile with secondary oxihydroxide minerals ; on low plateaus, ferricretes with high Si, Al and goethite contents are also the richest in Mg, K, Cr, Zn, Cu, Sc, Y and Yb, which represent the geochemical spectrum of a basic parent-rock which is still preserved in the least evolved lateritic covers.

From a factorial analysis in principal component the statistical study permit to put in evidence geochemical groups which are specific of each weathering facies. Therefore : lithomarge characterized by a geochemical group constituted by kaolinite, SiO_2, Al_2O_3, TiO_2, Y, Zr, La and Yb, is opposed to the ferricrete defined by the group, Fe_2O_3 and V ; the group of goethite, Sc, Zn and Cu is opposed to the group of hematite, which shows clearly the antagonism between the oldest massive hematitic ferricretes and the youngest vacuolar geothitic ones ; the group of the kaolinite opposes to that of the gibbsite, which shows the difference between the two main facies of the lithomarge, and in an other hand the mineralogical opposition between the ferricretes of plateaus and the ferricretes of slopes ; the group of P, Sr, Ba, Ce and Eu is specific of the neoformation of phosphated minerals in ferricretes ; the group of Mn_3O_4 and Co characterizes the neoformation of asbolane in soft ferricrete layer of the weathering profiles which are situated on the slopes and the low parts of landscape.

Thus, the influence of the nature of the parent rocks and the fluctuations in morphoclimatic change over 70 My play an important part in the mineralogical and geochemical differentiations and in the evolvement of each successive lateritic weathering facies in the Dembia-Zemio region.