# Landform and regolith in the Tenkoto area (Eastern Senegal)

Cédrick Gineste, Exploration Geologist, [www.pangeology.com](http://www.pangeology.com)

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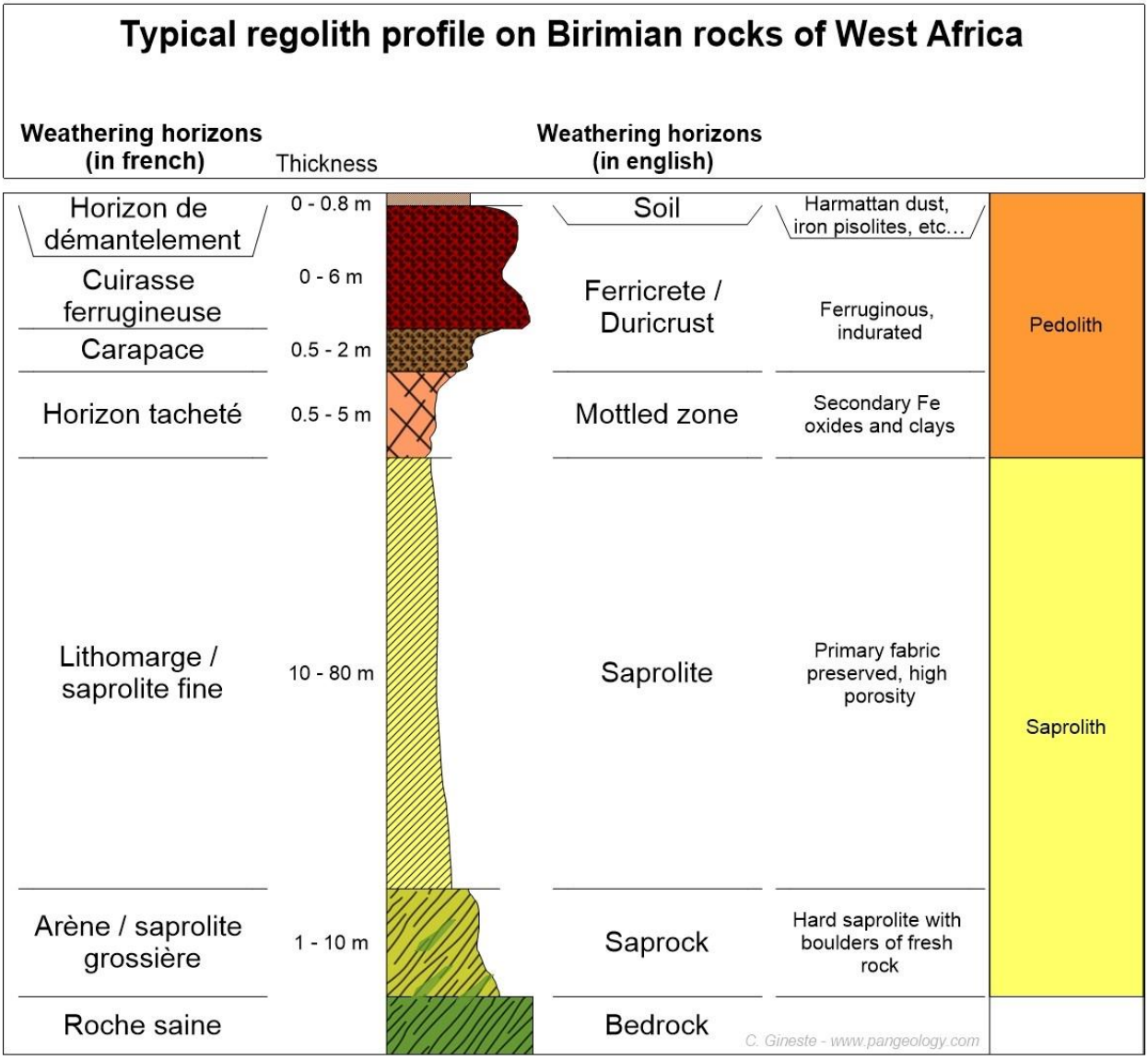
*The weathering profile developed on the Birimian rocks of West Africa is, or looks, relatively simple. But its genesis is not. A few years ago, within a IRD team, I worked in the Tenkoto area (Senegal), already studied by P. Michel in the 60's and 70's and very adapted to examine the filiation of the ferricrete.*




In the 1960s and 1970s, several BRGM and ORSTOM researchers were interested by the weathering profiles capped with a ferruginous duricrust (aka ferricrete or *cuirasse* in French), particularly in Senegal. Two schools of thought confronted each other on how the weathering profile was formed.

**The autochtonist school (residual ferricrete)**

Nahon, Pion and Leprun studied the weathering processes on a geochemical scale and see the profile as a logical succession of alteration that gradually deepens. They consider ferricrete as the ultimate stage of rock weathering.

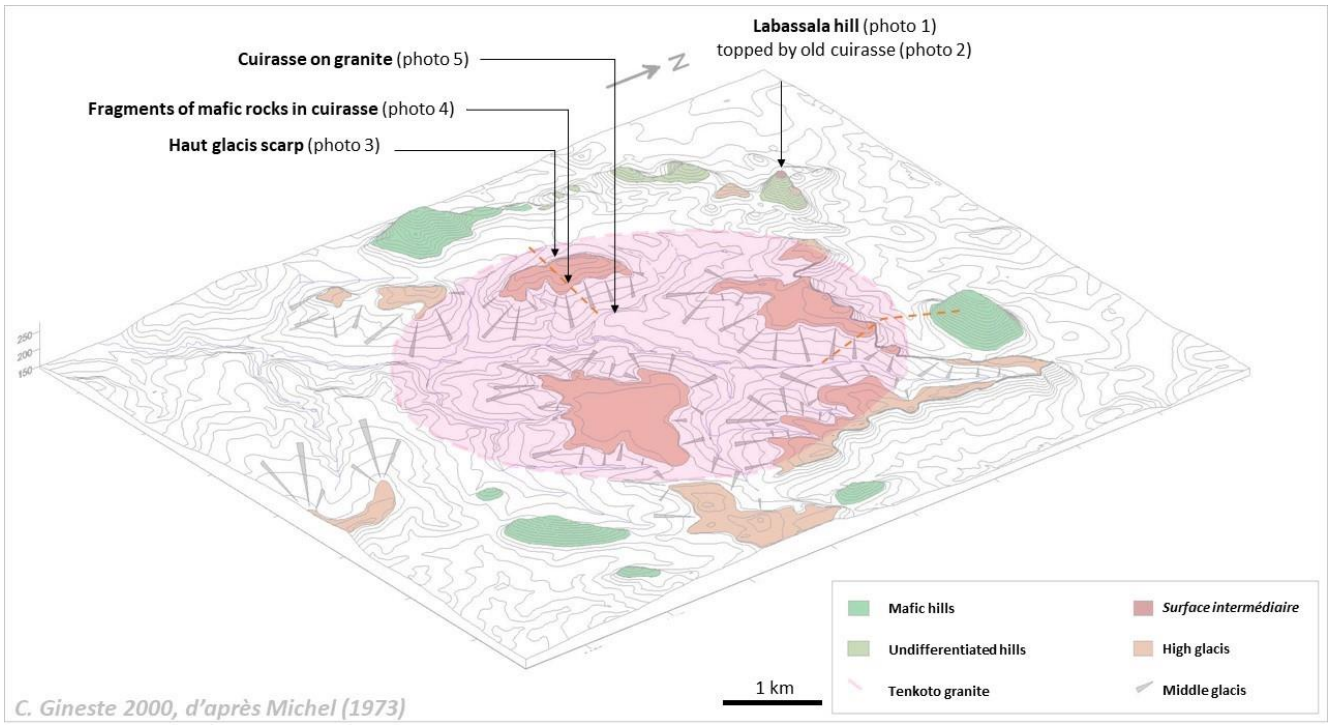
**The allochtonist school (transported ferricrete)**

To these three authors, who envisage the autochthony of ferricrete, is opposed the vision of the geomorphologists Michel, Grandin, and Boulet, who studied ferricretes on a much larger spatial and temporal scale. Indeed, they distinguish the residual bauxitic duricrust of the old African Surface from the younger ferricretes which, according to them, largely correspond to the cementing of detrital material and the remobilisation of iron from the overlying duricrusts in the landform.

To put everyone in agreement, it would seem from our experience that **both cases of residual or transported ferricrete can be found in West Africa** - even if they are mostly transported.

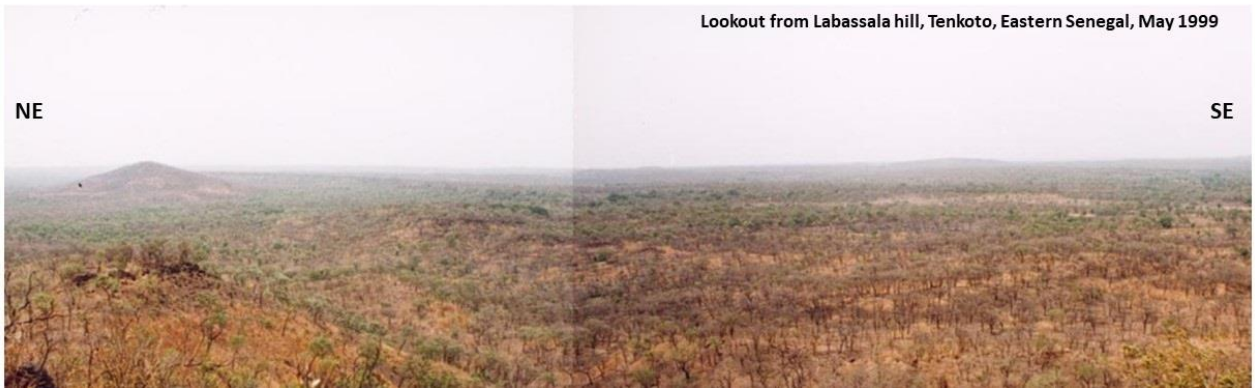
Let's look at a typical case of a transported ferricrete following the footsteps of P. Michel who studied the geomorphology of Eastern Senegal and particularly the Tenkoto area (where I worked in 1999-2000).

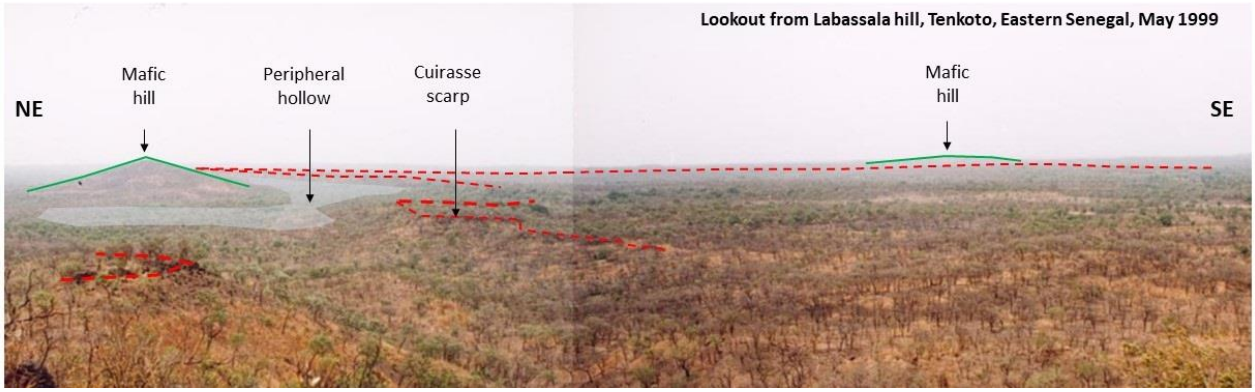
The study area is centred on the Tenkoto granite batholith. It is a Bondoukou (post-tectonic) granite in the Bassot (1966) classification. It has a circular shape with a diameter of 5 km and intersects the terranes of the Mako series. It is visible on the outcrop mainly in the talweg that crosses it from NE to SW.

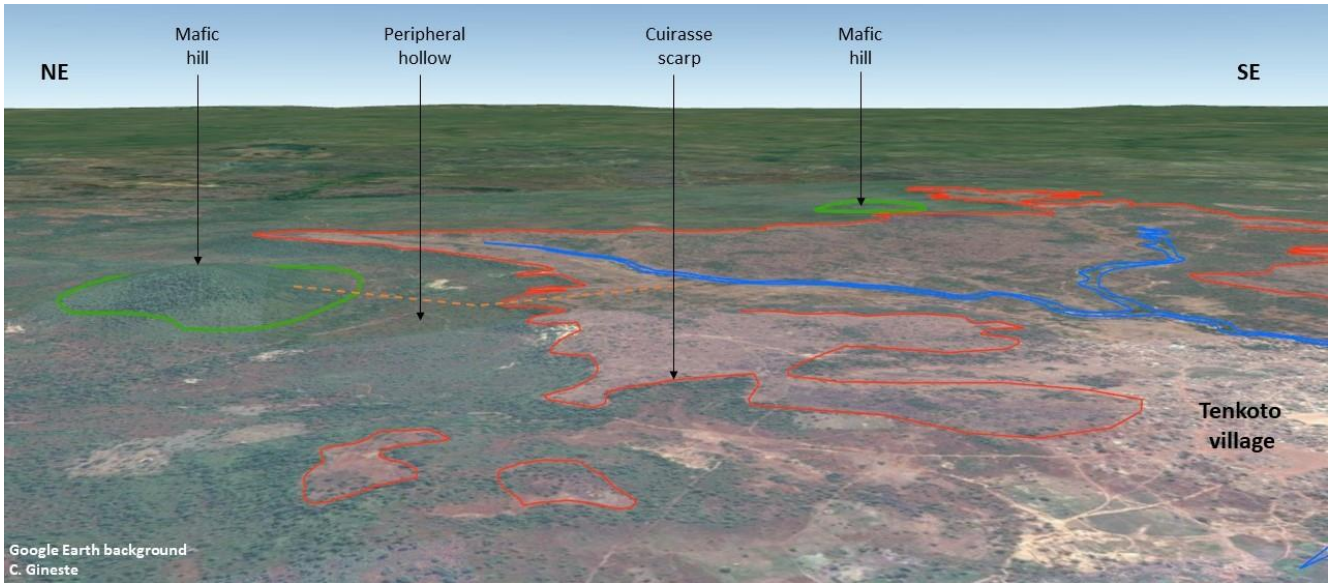



Quartz veins mineralised in Pb, Zn, Mo and Au occur at the edge of the granite and are the target of orpailleurs. The Massawa gold deposit, discovered by Randgold a few years ago, is located about 5 km NE of this area.

A set of hills that have resisted erosion form a discontinuous belt around the Tenkoto granite. The most remarkable relief is the hill of Labassala located to the N-W of Tenkoto at an altitude of about 280m. It has a conical shape with regular flanks, its summit is topped by a relic of duricrust from the Intermediate Surface, believed to be of Pliocene age, which limited the erosion of the underlying schists. The other hills, made up of basic rocks, have a classic rounded shape of inselberg type.

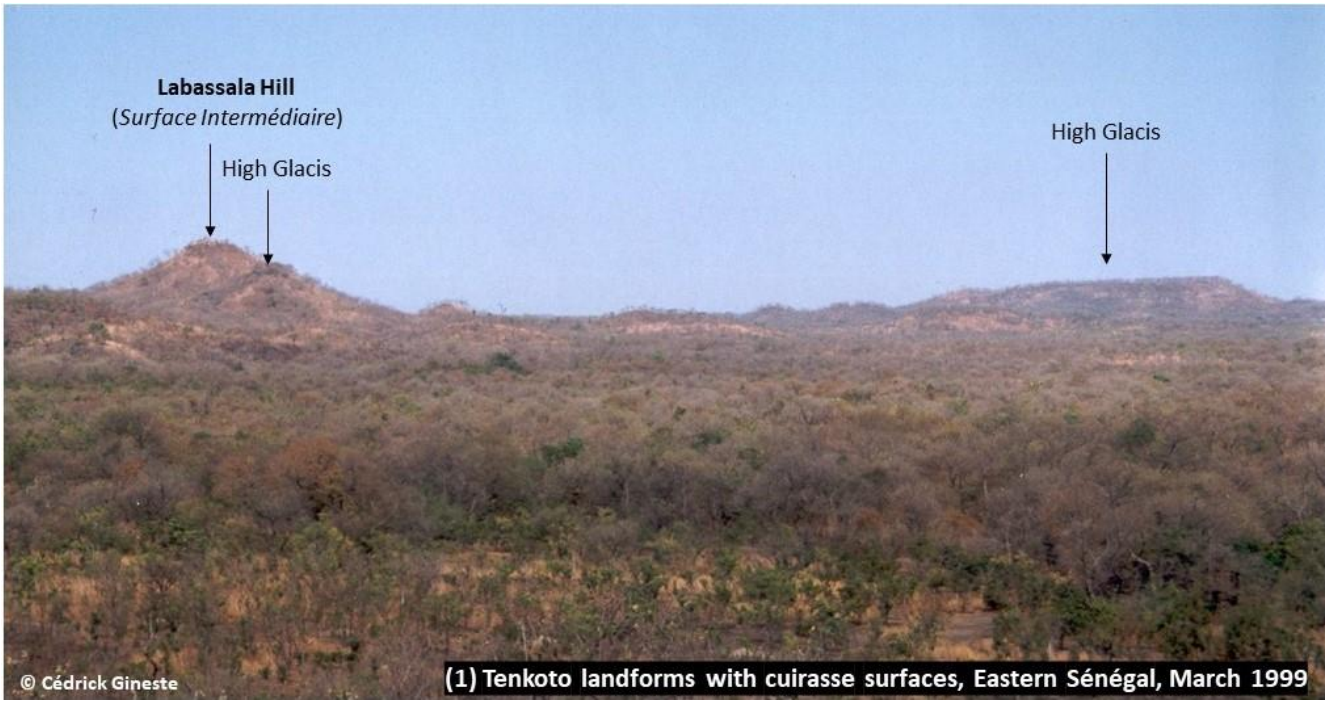


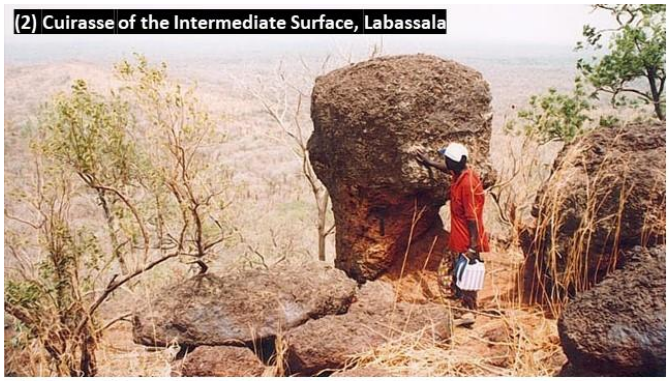



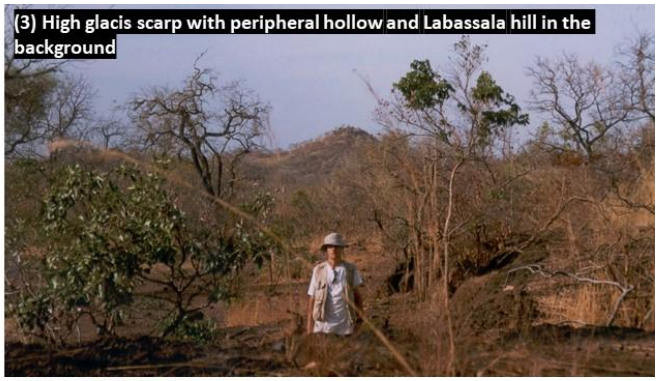




The granite is largely hidden by two stepped ferricrete surfaces (or pediments/glacis), organised in relation to the NE-SW oriented marigot of Tenkoto and its tributaries, the high glacis being about ten metres above the middle glacis. The ferricrete plateaus are bordered by trees fringes at the level where they break up on the wooded slopes leading to the lower level.

The glacis are separated from the basic rocks' hills by a deep peripheral hollow where the rock, or saprolite, is subcropping. This results in a landscape of inverted relief, which is particularly clear to the north-east of the area.

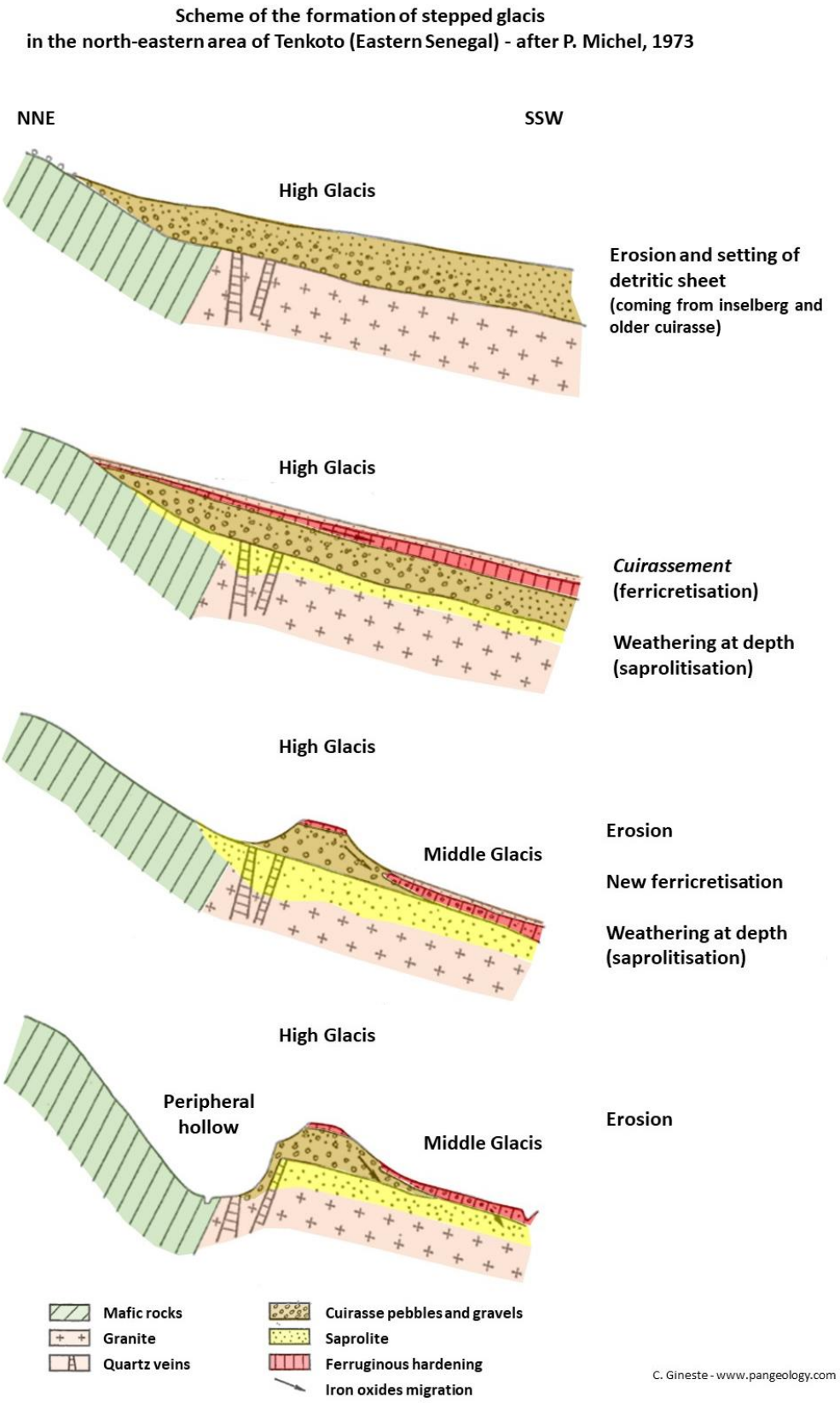





The texture of the ferricrete clearly shows that it is allochthonous, with locally distinctive basic rock fragments in the ferruginous material capping the weathering profile on granite. In the lower part of the middle glacis, the ferricrete rests directly on the granitic bedrock.




Michel's interpretation distinguishes three phases of erosion separated by two periods of ferricrete formation. Wet periods favoured weathering at depth and the formation of ferricretes while the resulting landscape was eroded and dissected during dry periods, leading to new landforms and the current shape of stepped high glacis and middle glacis.

In such a context it is easy to understand that not all soil geochemical gold anomalies (positive or negative) are alike. A mapping of the landforms and the regolith is therefore necessary. New technologies such as Lidar and satellite imagery are now available to facilitate this work, but a field mapping with landscape reading will always be necessary to decipher the geochemical results. We will come back to this later.

**Few references**

Michel P. (1973) - Les bassins du fleuve Sénégal et du fleuve Gambie. Etude géomorphologique. *Mémoire ORSTOM n°63, 752 p.*

Beauvais A. et al. (1999) - Analysis of poorly stratified lateritic terrains overlying a granitic bedrock in West Africa, using 2-D electrical resistivity tomography. *Earth and Planetary Science Letters 173, pp. 413-424.*