SCIENCE DU SOL n° 1986/1 - pp. 105-106 - PLAISIR-FRANCE

RELATIONSHIPS BETWEEN WATER FLOW AND SOIL MORPHOLOGICAL FEATURES IN A CAMBISOL

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(Science du Sol n° 1982-1)

The relationships between water flow and soil morphological features were considered in the case of a calcareous soil, carbonates being the morphological tracer. We searched for a convenient place to study both the evolution of secondary carbonates and the soil water regime. For this purpose, we regarded a spot on the landscape where plants were clearly affected by Fe chlorosis as revealing both a lateral soil heterogeneity and a particular hydrodynamic behaviour. We compared hydrodynamic behaviour and soil morphology at the chlorosis spot and outside the spot. This work was under taken at a very large mapping scale (1/100).

The selected site belonged to a calcic cambisol map unit defined on the scale 1/5 000 and had a horizon of carbonate accumulation. Detailed mapping showed inclusions of other soils in the map unit, including both calcareous and non-calcareous soils (fig. 1).

At the chlorosis spot (H), measurements of hydrodynamic behaviour showed the critical effect of a physical discontinuity between the cultivated horizon and the horizon of carbonate accumulation (fig 8). When water was added to the surface, this discontinuity reduced infiltration into the horizon of carbonate accumulation, where water continues to move upward by capillary action for long periods (fig. 5).

Outside of the chlorosis spot (h), there was no discontinuity, and water flowed through the whole profile. This water regime was related to lateral movement of water on the top of the horizon of carbonate accumulation and from the center of the center of the chlorosis spot towards its periphery.

The carbonate accumulation horizon had very distinct morphological features :

- At the chlorosis spot (H), there was a dense matrix with finely divided carbonates. Pore walls were covered with secondary carbonates (photo 3), demonstrating that carbonates were being precipitated.

- Outside the chlorosis spot (h), very porous, large veins of clay deeply penetrated the horizon. Pore walls, both in the clay veins and in the calcareous matrix, were covered with oriented clay coatings (photos 1 ans 2). These features indicated that soils outside the chlorosis spot were subject to carbonate dissolution processes related to free percolation of infiltrating water.

In conclusion, this pedogenetic system is composed of two interacting subsystems (fig. 9) : one (the chlorosis spot) where carbonates are precipitating and one (outside the chlorosis spot) where carbonates are dissolving. Therefore, while the evolutionary trajectories of the two subsystems diverge, in the long run the whole system is losing carbonates. Such a pedogenetic pattern may be seen currently in the pronounced lateral differentiation of the soils.

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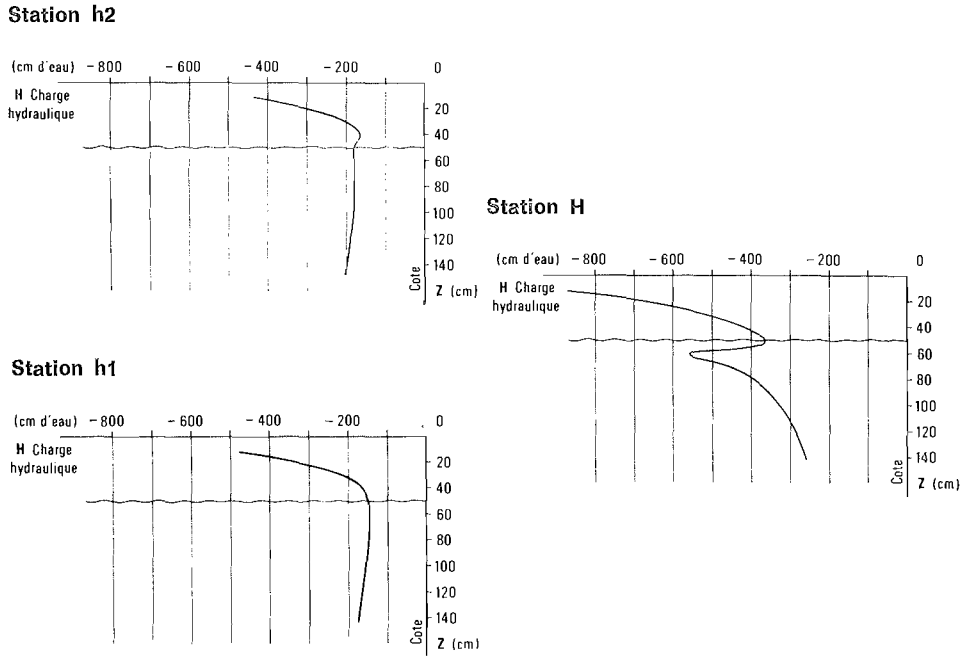

Figure 5 : Hydraulic load profiles after an irrigation.

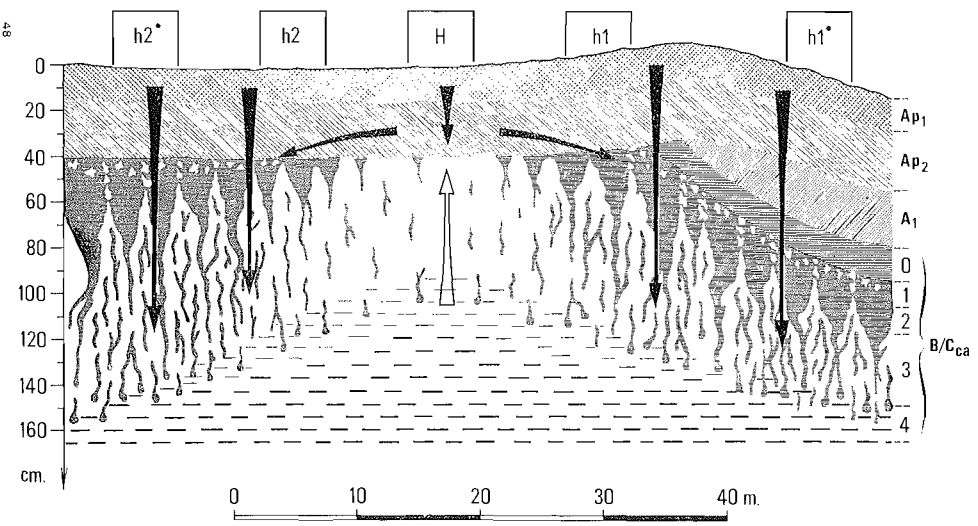

FIGURE 1X. — *Représentation schématique de la dynamique de l'eau du système pédologique*
Schematic representation of pedologic system water dynamic

Figure 9 : Schematic representation of the dynamics of water in the pedological system.