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A methodology to reduce the intake of nitrate to rivers and coastal regions in fissured and altered hard-rocks

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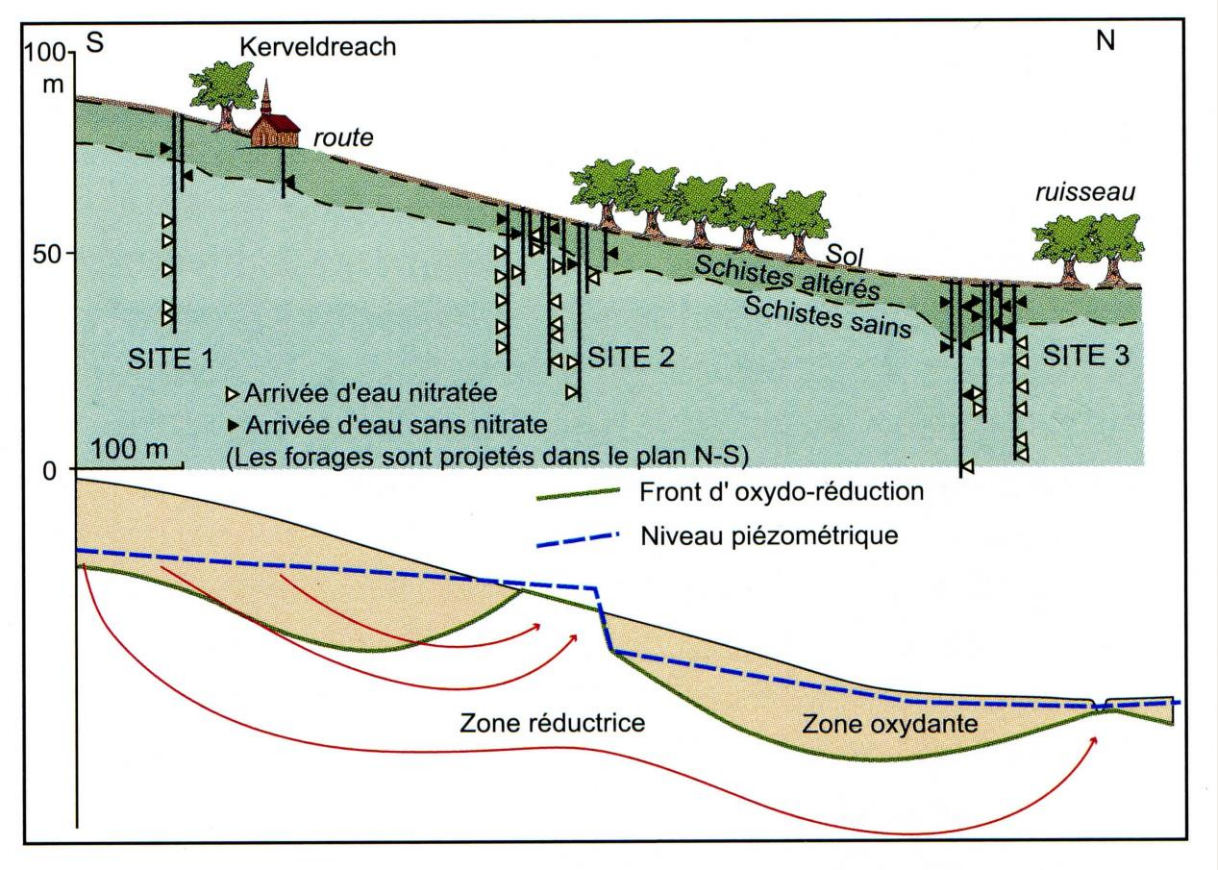
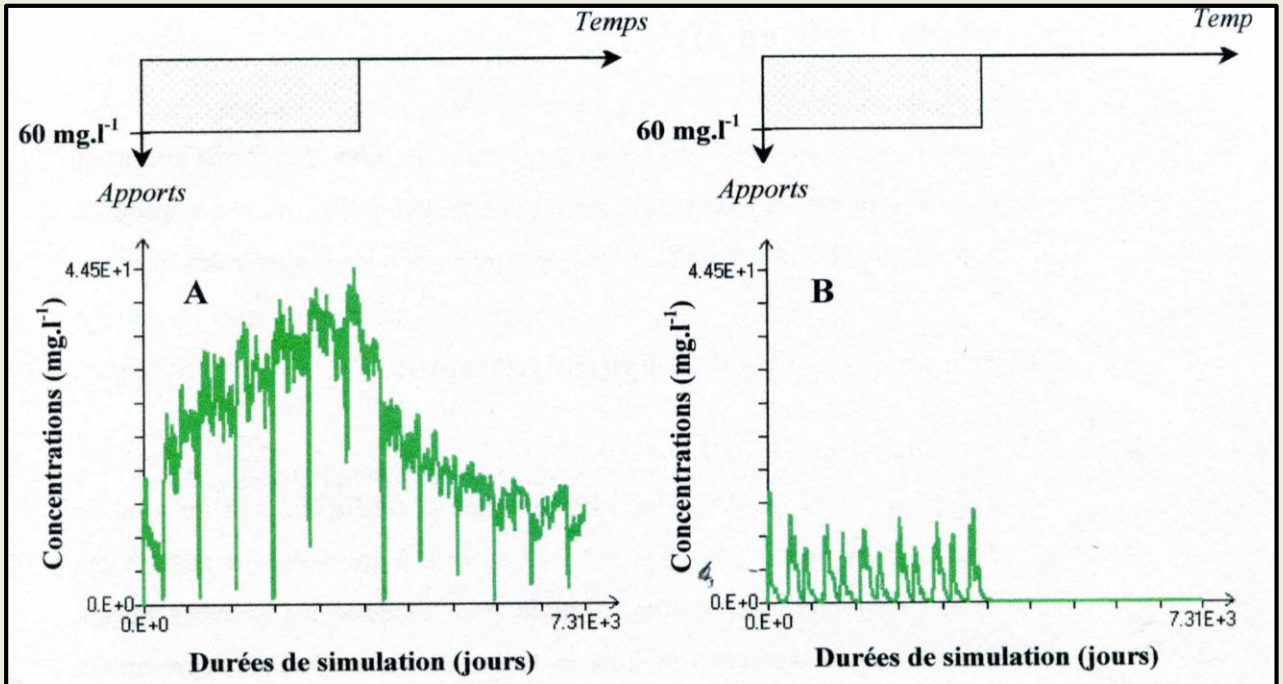


1. Schematic lithological and hydrochemical cross sections in the experimental perimeter of Kerveldréach (PEK), Finistère, Brittany, western France.

The top cross section shows lithology and the bore-holes of the 3 sites installed on a slope, constituting the périmètre expérimental de Kerveldréach (PEK) with arrivals of water, nitrated or not.

The bottom cross-section interprets the observations and data acquired during a decade of study. The shift of the piezometric surface is due to a zero flow hydraulic singularity, which causes artesianism in high water. Hydrochemically, there is an oxidazing zone with nitrate and dissolved oxygen (DO), and below, no nitrates or DO, but ferrous iron, sulfate and abundant gas, for exemple. (After Faillat, Somlette and Sicard 1999)



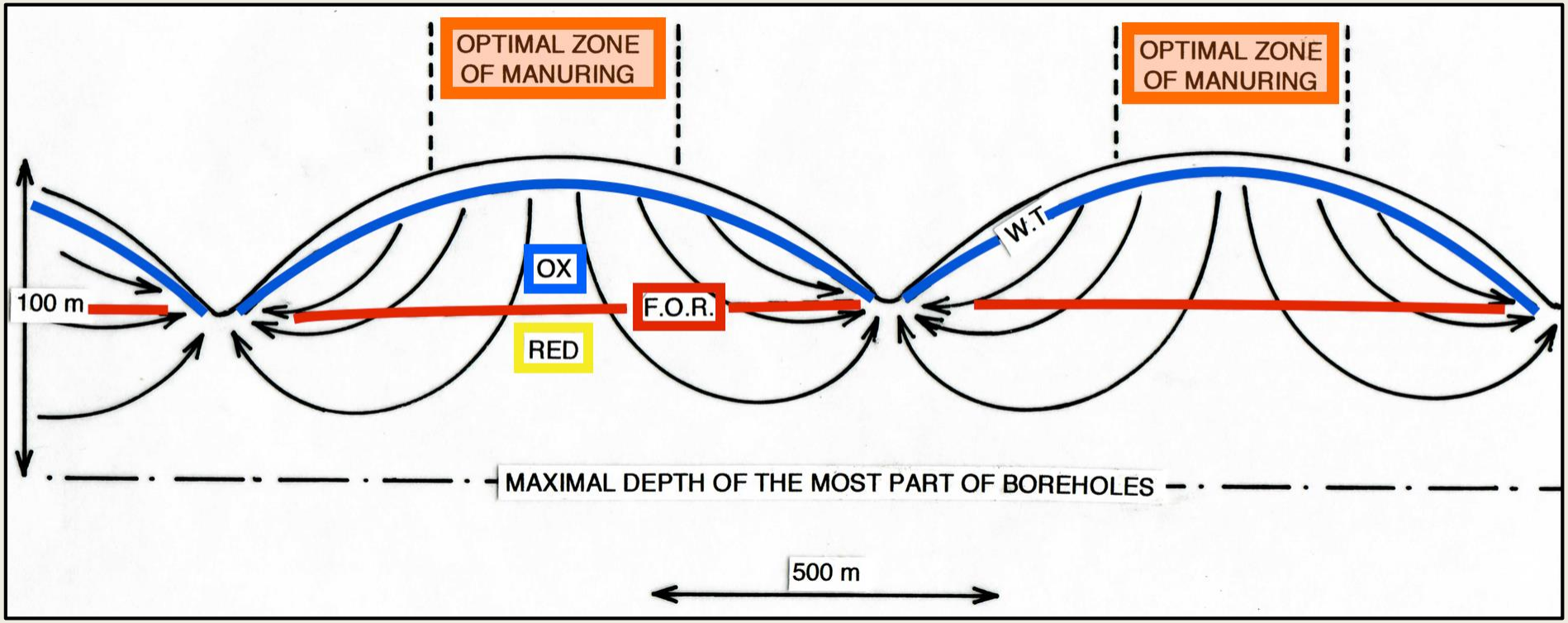
Durées de simulation (années)	Type	Apports (kg de NO_3^-)	Sorties du système (%)	Dénitrification (%)
1	Sans FOR	18.7	8.9	-
	Avec FOR	18.7	2.5	***74.4***
20	Sans FOR	220.3	73.9	-
	Avec FOR	220.3	4.0	***90.6***

2. Simulation of the denitrification

Representation of the simulated breakthrough curves at the output of the hydrogeosystem in the river, without (A) and with (B) redox front. Significant improvement is possible in less than 2-5 years.

In the table : Balance of the quantities of nitrates brought, denitrified and exported by the river (after Goujon 2005). FOR : Redox Front (After Edmunds 1973).

The two scenarios A and B may be considered respectively as what happens near a river or away from her.



3. Schematic layout of optimal manuring areas in endogenous rocks basement with moderate relief.

The effects of three types of phenomena are superimposed:
- The lithology, with more or less altered shale containing sulphides.
- The water chemistry, with an oxidizing layer on a denitrifying reducing layer.
- Hydrodynamic, with current lines passing or not by the denitrifying zone, where nitrates are reduced.

It follows that the application of nitrogenous material must be excluded near rivers and permit only on a part of the interfluves. (After Faillat 2012, 2013)