USING DGT TO STUDY THE STRATIFICATION OF UNDERGROUND WATERS

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AIM OF THE PROJECT

Underground waters have in some cases a high spatial variability of chemicals parameters. This stratification due to geological topology, pollution behaviors is hard to investigate with usual techniques like piezometer pumping and sampling.
Thanks to passive sampling devices like DGT (Diffusive Gradient in Thin films), innovative methods became helpful and are experimented through this project on an industrial site.

EXPERIMENTAL SECTION

Two piezometers on an industrial metallurgic site in France were chosen. The first one called PzA is downstream section of a garbage dump of metallurgic waste and 6.1 meters deep. The second one, called PzB, is downstream section of controlled alveolus garbage dump of metallurgic waste and 4 meters deep.

The approach below was made for each piezometer.

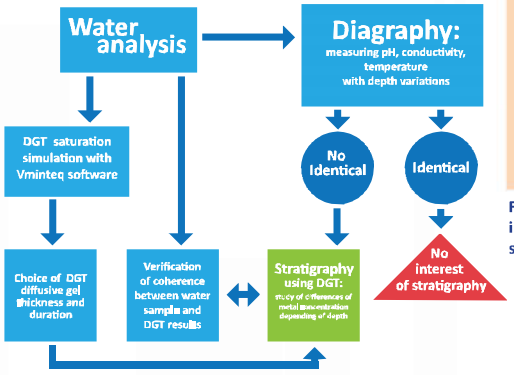


Photo 1 : DGT exposed in triplicata on plastic rope

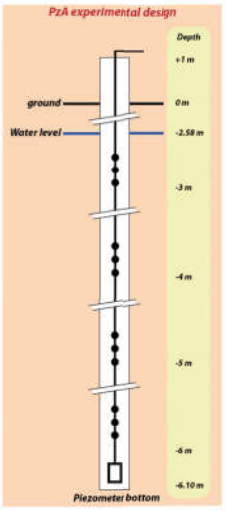


Figure 2 : Experimental DGT installation to study stratigraphy in PzB

CONCLUSIONS AND PERSPECTIVES

The DGT as a passive sampling method allows to determine a vertical profile of metal concentrations. The results of the DGT analysis give more information on the underground water than classic water sampling. Using a diagraphy with pH and conductivity before using the DGT technique gives a first estimation of a possible stratification of pollutants in underground water.
DGT could be used not only on clean sites but also on industrial sites with high levels of contaminations using short time deployment and thick diffusive gel.

RESULTS AND DISCUSSION

Analysis of water sample before and after purge

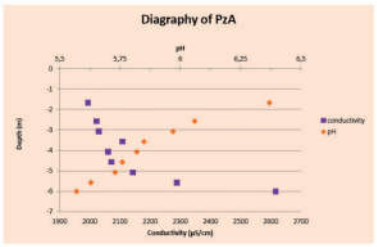
PzA concentration	Zinc (µg/L)	Cadmium (µg/L)	Lead (µg/L)
BEFORE purge	269 000	2 160	<5
AFTER purge	272 000	2 190	<5

PzB concentration	Zinc (µg/L)	Cadmium (µg/L)	Lead (µg/L)
BEFORE purge	<5	<0.2	<0.5
AFTER purge	152	1.03	1.02

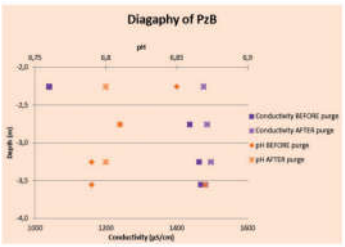
Table 1 : Results of filtered (0.45µm) water analysis with pumping in PzB

PzA purge has a very low influence on water parameters on the opposite of PzB. Thus, interpretation of PzB results must be conducted carefully.

Results of Diagraphy



Graph 1 : Results of diagraphy with a probe in PzA

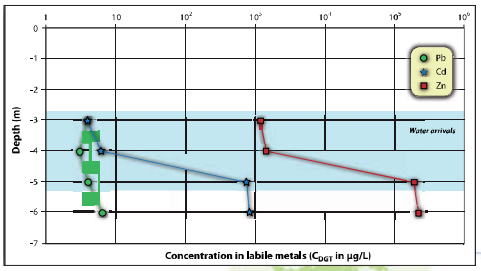


Graph 2 : Results of diagraphy with a probe in PzB

PzA show significant variations of pH and conductivity depending of the depth in underground waters : stratification into the piezometer is characterized. PzB on the other side shows more homogeneous results over the whole water column making it less suitable for stratification sampling experiments. As a result, PzA is chosen for stratification tests (Figure 2).
The simulation made with Vminteq software showed that because of the high concentrations of metals in the underground waters studied on this industrial site, DGT with a thickness of a diffusive gel of 1.96 mm could be used during only 12 hours without being saturated.

Results of Stratigraphy using DGT

The results of DGT stratigraphy show coherent values with water analysis and with the variation of chemical parameters (pH, conductivity) according to depth : the deeper it is, the lower the pH is and the more metal concentrations there are. For each measurement point, three DGT samplers were used to check repetitiveness and to mesure accuracy. Results show for each point low dispersion of values which highlights confidence in the results.



Graph 3 : Results of stratigraphy using DGT samplers in PzA

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Acknowledgements
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