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Characterization of nitrogen origins in karstic aquifers in watershed of Paris by measurement of the isotopic composition of various forms of nitrogen

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The company " EAU DE PARIS " manages the drinking water supply of Paris. The annual production is of approximately 700 million cubic meters of water. Half part comes from groundwaters; karstified chalk essentially. Some watersheds used for production of drinking water are located near Fontainebleau (77). Bourron, Villeron and Villemer sources supply almost 6% of drinking water distributed to Paris. These sources are caught in the senonian karstified chalk. These springs are located in the Lunain watershed and the Loing watershed. Although these springs are close geographically, hydrochemical and geochemical characteristics are very different:

Source of Villemer: turbidity associated or not with specific bacteriological and phytosanitary products; strong inter-annual and seasonal variability of nitrates, from 30 to 50 mg/l.

Collecting field of Villeron: the inter-annual and seasonal variability of nitrates is less important than Villemer, but much more enriched with nitrates (from 50 to 55 mg/l), presence of phytosanitary substances.

Collecting field of Bourron: these collectings present the lowest nitrate concentrations and produces the largest daily discharge; phytosanitary products are not present.

Many hydrogeologic studies, especially artificial tracing carried out since 1901 have shown that waters of the Lunain River are connected with all the three springs. Sources of Bourron seem to be connected with Lunain river waters, although belonging to an-

other watershed (Loing). Moreover, waters resulting from the leaching of crops and the discharge of water treatment plant in the Lunain River could contribute to the pollution of the drinking water supply. The hydrogeologic understanding of these karstic systems is complex and the origin of collected water is not well known. The study was focused on multi-isotopic measurements (delta-15NO3- and delta-15N-NH4+) to better understand the origin of the nitrogen sources found in the collected sources. The results of this study demonstrate that:

- Collecting field of Villeron seems to be supplied by groundwater in low and high water flows, and by an additional contribution of nitrates leaching from the agricultural soils in high water period.

- Source of Villemer may be the result of a mixing of different waters coming from different origin, such as groundwaters, superficial waters, nitrates leaching from agricultural soils; and probably the contribution of sewage waters that could explain the bacterial contamination observed in this source.

- In the collecting field of Bourron, any exchanges with Lunain River were not shown, and no denitrification process was observed.