Development of a groundwater monitoring network in Niger – Results of isotopic and hydrochemical analysis

Project AGES – Appui à la Gestion des Eaux Souterraines à l'Autorité du Bassin de Niger (ABN)

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Introduction

The BGR project AGES aims to establish a groundwater monitoring network in the Niger River Basin. In the southern Niger pilot zone continental sediments form up to three superposed confined aquifers (Greigert, 1957, 1978; Boeckh, 1965; FAO, 1970). In order to identify major challenges for groundwater management, isotopic and hydrochemical samplings were conducted by the AGES project and by the IAEA project RAF/7/011. The results point out zones of increased EC values and the exploitation of paleo waters from the deep confined aquifers.

Stable Isotopes ^{2}H and ^{18}O

Previous studies showed that stable isotope signatures in the deep confined aquifers are depleted in ^{2}H and ^{18}O compared to the unconfined aquifers. The depleted isotope signatures ($\delta^{2}H$ < -45‰) are related to paleo climatic recharge conditions and residence times >24 000 a (Guéro, 2003).

The present data shows that groundwaters with depleted isotope signatures are exploited in the Dallol Maouri and in the area west of Dallol Foga (Fig.1). Between Dallol Foga and the Niger River Valley groundwaters exhibit recent isotopic rainfall signatures.

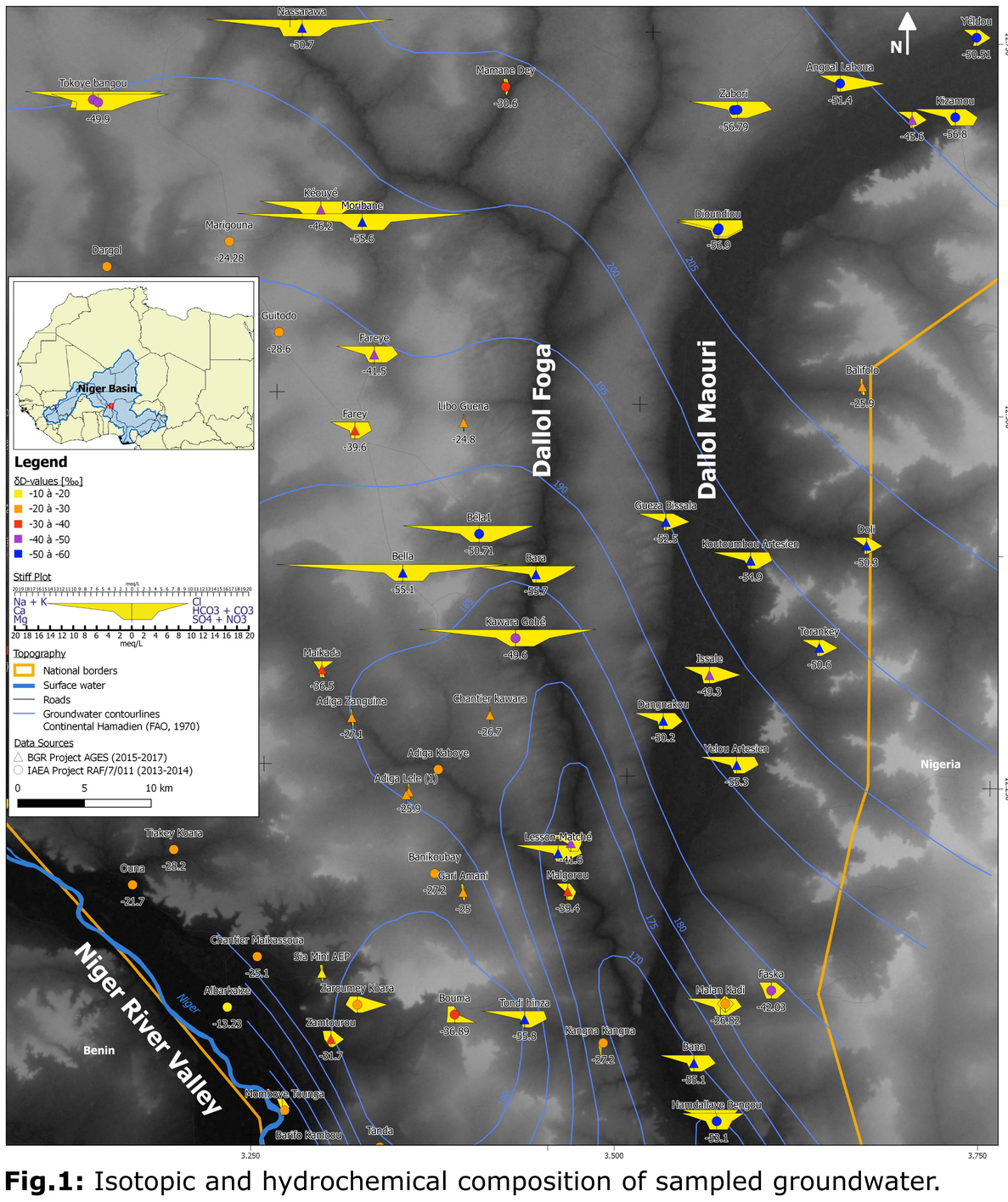

Fig.1: Isotopic and hydrochemical composition of sampled groundwater.

Electrical Conductivity

Zones of high NaCl-concentrations were identified west of Dallol Foga, where EC values rise up to 2700 µS/cm (Fig.1). Following the classification of Wilcox (1948), four water samples in this area fall into the class *doubtful* to *unsuitable* for irrigation purposes (Fig.2).

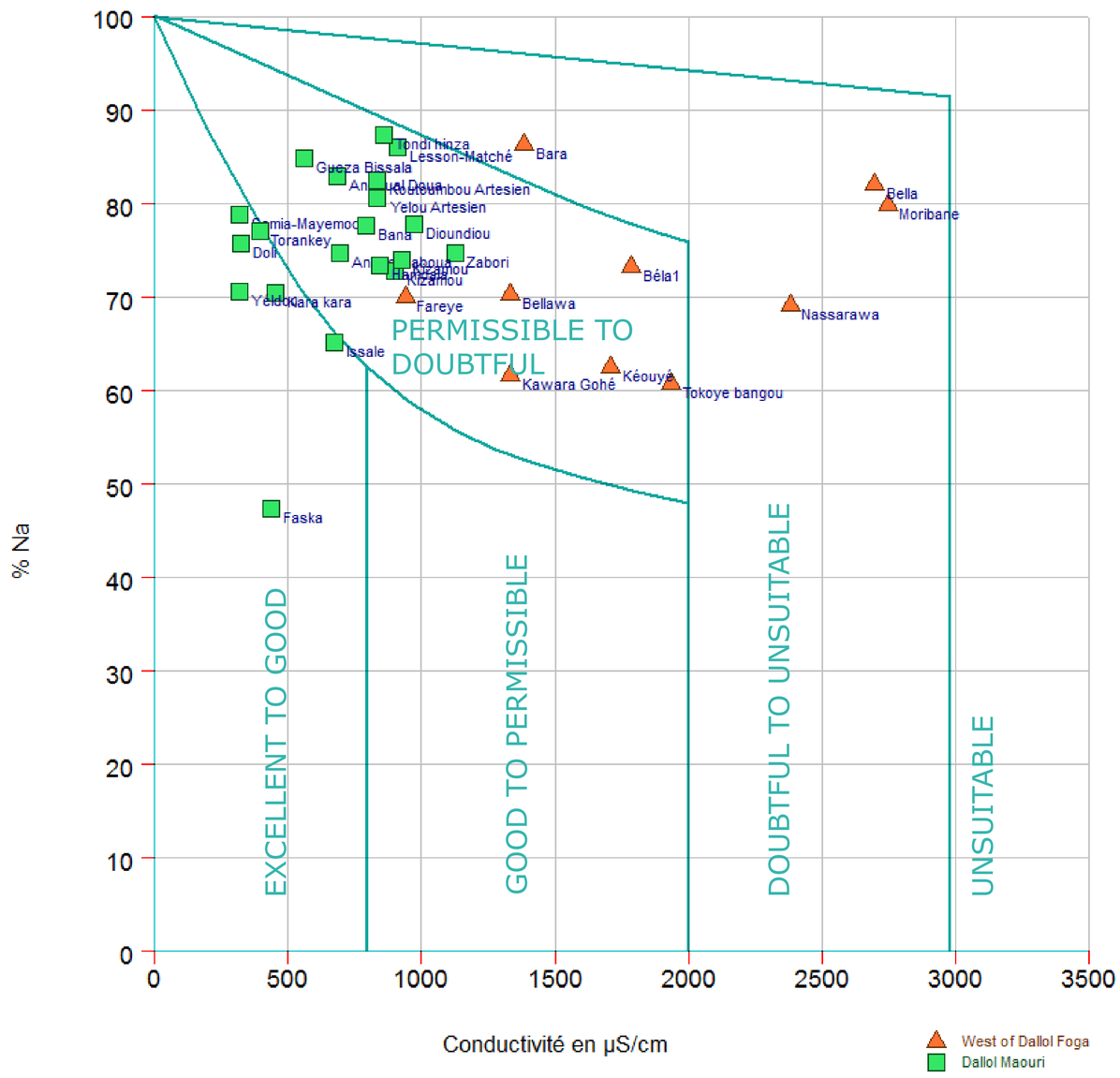

Fig.2: Applicability of groundwater from the deep confined aquifers for irrigation purposes (after Wilcox, 1948).

Implications for Groundwater Monitoring

1. Agricultural irrigation schemes targeting the deep confined aquifers should include an adapted groundwater monitoring. This should take into account the quantitative impacts on paleo water resources and the risk of mobilization of groundwater with elevated NaCl-concentrations.
2. Groundwater with recent isotopic rainfall signatures is generally associated to shallow unconfined aquifers and, therefore, is vulnerable to anthropogenic contamination and land use changes. Agricultural and industrial activities in these areas as well as sanitation infrastructures should be accompanied by the establishment of groundwater protection zones and a dense monitoring of anthropogenic pollutants.

Acknowledgments

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