

# THE DIAGNOSTIC ANALYSIS OF THE GROUNDWATER RESOURCES OF THE AQUIFERS OF THE COASTAL BASIN OF TOGO

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## BACKGROUND

In Togo as well as in all the countries of the Gulf of Guinea, water is a critical factor of socio-economic development and is significantly instrumental for the survival of natural ecosystems. Nevertheless, the resource is seriously compromised by several environmental risks including; a higher population pressure, a progressive land degradation, a fast-growing industrial sector, an increasing degradation of water quality, a progressive rainfall scarcity in the basin and its conjunction with a drastic reduction of the groundwater recharge, a lack of knowledge in the interaction between the aquifer recharge process and the recharge areas as well as the geometry of aquifers, the real linkages between surface water and groundwater layers in both of the basins, the unplanned use of water resources and the lack of monitoring activities. Besides the above mentioned considerations, a lack or an inefficiency of an institutional framework to prevent the development or adoption of an effective management approach of water resources at the local level. The situation is very serious and requires an urgent and effective action to address this alarming outlook. We propose in this work the formulation of a Strategic Action Plan (SAP) and the development of a Diagnostic Analysis (TDA) for setting up laws and institutions responsible for the use and protection of the shared groundwater resources.

## GEOLOGY AND HYDROGEOLOGY

The sedimentary basin (Fig. 1) is 60 km wide in the east (border with Benin) and 25 km wide in the west (border with Ghana). It is transgressive over the crystalline basement of the Dahomeyides range, which consists of migmatites, orthogneiss with biotite, granites and calcalkaline granodiorites (Johnson 1987). The basin has been strongly affected by tectonics and hence compartmentalized. The throw of the longitudinal faults sometimes reaches 100 m and the bedrock dips from the northeast toward the southwest. The morphology of the sedimentary layers follows the tectonics of the basin (Johnson 1987; Johnson et al. 2000). Two quite distinct series overlie the crystalline basement (Fig. 3):

- (1) A Maastrichtian/Eocene marine series consisting of sand, marly limestone, marl and clay dipping toward the South
- (2) A Quaternary series of continental and coastal origin resting horizontally and discordantly on the marine series. It consists of sand, gravel and sometimes clay with a great number of lateral facies variations.

At the basin scale, one can group together the sedimentary formations so as to define three aquifers of regional significance, each with its specific geology and hydraulic head (BNRM 1986). They are, from top to bottom (Fig. 3; Table 1):

- (1) The unconfined sand-and-gravel aquifer of the Continental Terminal linked to the unconfined aquifer of the Quaternary sand dunes;
- (2) The confined aquifer in the Eo-Palaeocene sand and Limestone
- (3) The confined aquifer in the Cretaceous (Maastrichtian) sand

The aquifers are inter-bedded with clayey layers of varying thickness (Fig. 3). The flow direction is generally from North to South (DHE 1982, 1983; BNRM 1986).

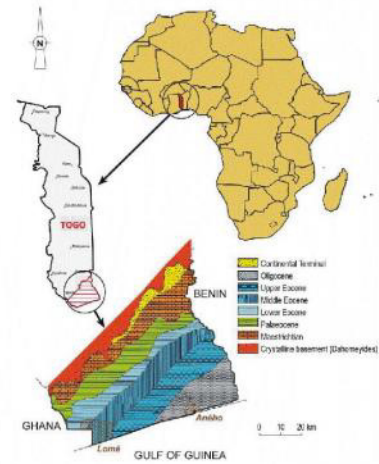


Fig. 1 General geological context and lithological formations of the Sedimentary Coastal Basin, stripped of the Quaternary and Continental Terminal layers. Modified from Johnson et al. (2000)

## THE SERIOUS PROBLEMS EXISTING AND EMERGING THAT REPRESENT THREATS FOR THE GROUNDWATER RESOURCES OF THE COASTAL BASIN OF TOGO

- 1- The lacks and insufficiencies in collecting hydrological and climatic data
- 2- The insufficiencies of hydrogeologic knowledge of the aquifers:
  - Geometry of the aquifers
  - Hydrodynamic, their piezometry
  - Recharge processes and recharge areas
  - Interactions between surface water-seawater and groundwater.
- 3 The **bad management** of the resources:
  - Overexploitation of the aquifer of the Continental Terminal
  - Saltwater intrusion enhanced by the over pumping
  - Lack of the protection zones of the aquifers against various forms of threats of pollutions.
- 4 The insufficiencies in the national capacities of **water supply**:
  - Not all peoples have access to potable water even in the big cities
  - Subscription fees too high for poor peoples
  - Numerous private suppliers are selling water for peoples
- 5 The environmental problems among which:
  - climatic changes, the wild **urbanisation**, rapid growing populations, decrease in rain fall intensity since decades in the basin, floods, mining activities and the dumping of mine tailings into the sea, land degradation, growing urban insalubrities (wild cities dumps), pollution by heavy metals, pesticides, nitrates and microbes.

## STRATEGIC ACTION PLANS

### KEY OBJECTIVE

The key objective of the project is to establish, at a sub-regional level, a joint management organism for the shared aquifers of the Gulf of Guinea. The key objective can be summarised in three major actions: An identification of emerging risks and uncertainties relating to the hydrology, the use of water resources and land in the context of the social and economic development of the coastal areas;

- The development of a Diagnostic Analysis (DA);
- The formulation of a Strategic Action Plan for setting up a management body for the aquifers. The development of the strategic plan of action shall involve the managers of the resource, the different users as well as the administrative authorities in charge of coastal cities.

### SPECIFIC OBJECTIVES

- Study climate variability and change
- Study of the salt-water wedge in all aquifers
- Acquaintance with aquifer systems at the local and sub-regional levels
- Aquifer System Modelling
- Examine the interaction between surface water, groundwater and seawater
- Examine land use and modification
- Examine the groundwater quality and assess the aquifer vulnerability to pollution with a view to facilitating their protection
- Undertake a Transboundary Diagnostic Analysis (TDA)
- Set-up a co-operative regulatory and institutional framework to manage the project
- Strengthen national capacities in groundwater resources management
- Public awareness and Information dissemination

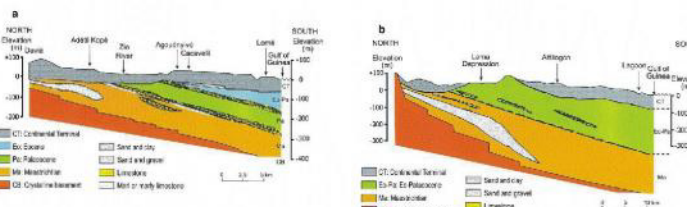


Figure 2 Transverse N-S geological cross-sections, as reported in Fig. 2 (modified from DHE 1982): a western cross-section; b eastern cross-section of the sedimentary coastal basin

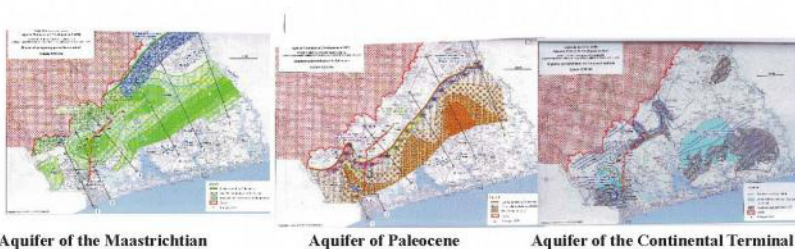


Figure 3: The Aquifer System of the Coastal Basin of Togo showing the 3 Main Aquifers with Their Geometry and Recharge Areas