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

By K. Onah, BSc of GEOLOGY, UNIVERSITY OF LOME, TOGO

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 a significantly insential for the survival of natural ecosystems. Nevertheless, the resource is seriously compartmentalized 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 uncertainty in the basin and its conjunctures with a drastic reduction of the groundwater recharge, a lack of knowledge in the interaction between the aquifer recharge processes and the recharge areas as well as the geometry of aquifers, for the real linkages between surface water and groundwater layers in both of the basins, the unplanned use of water resources and the lack of sustainable management practices.

Besides the above mentioned considerations, a lack of or an efficiency 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 transverse over the crystalline basement of the Dahomey Basin, which consists of metamorphic, orthoglyphous with biotite, granite and sub-basaltic granite dikes (Johnson, 1987). The basin has been strongly affected by tectonics and hence geographically divided. 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 topography of the basin (Johnson, 1987; Johnson et al., 2000). Two quite distinct areas overlap the crystalline basement (Fig. 1): (1) A Muscovite-Biotite complex consisting of sand, gravel, limestone, mud and clay deposits in the east; (2) A Quaternary series of continental and coastal origin consisting 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 hydrogeology and hydraulic head (B.N.R.M, 1986). They are, from top to bottom (Fig. 3; Table 1): (1) The confined sand and gravel aquifer of the Continental Terminal, limited to the unconfined aquifer of the Quaternary sand zones; (2) The confined aquifer in the Eocene, Paleocene sand and limestone; (3) The confined aquifer in the Cretaceous (Maestrichtian) sand.

The aquifers are inter-bedded with shelter layers of varying thickness (Fig. 3). The flow direction is generally from north to south (DWID, 1982, 1983; B.N.R.M, 1986).

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

Our work is based on the following assumptions:

- The aquifers are inter-bedded with varying thickness of shelter layers.
- The flow direction is generally from north to south.
- The aquifers are confined or unconfined.

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

The aquifers are inter-bedded with shelter layers of varying thickness (Fig. 3). The flow direction is generally from north to south (DWID, 1982, 1983; B.N.R.M, 1986).

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

1. The lack of and insufficiencies in collecting hydrological and climate data.
2. The insufficient knowledge of the hydrogeology of the aquifers:
   - Geometry of the aquifers.
   - Hydrodynamic, their piezometry.
   - Recharge processes and recharge areas.
3. The bad management of the resources:
   - Overexploitation of the aquifers of the Continental Terminal.
   - Salinisation enhanced by the water pumping.
   - Lack of the protection zones of the aquifers against various forms of threats of pollution.
4. The insufficiencies in the institutional capacity of water supply:
   - Not all people have access to potable water even in the big cities.
   - Insufficient distribution for the urban people.
   - Insufficient distribution for rural areas.
   - Numerous private suppliers are selling water for people.
5. The environmental problems among which:
   - Drainage problems, the wild urbanisation, rapid growing populations, decrease in rain fall intensity since decades in the basin.
   - Excess activities and the dumping of mine tailings into the sea, land degradation, growing urbanisation enhanced by solid wastes dumping, pollution by heavy metals, pesticides, nitrate and nitric.

STRATEGIC ACTION PLANS

KEY OBJECTIVE

The key objective of the project is to establish, at a sub-regional level, a joint management organ for the shared aquifers of the Gulf of Guinea. The key objectives can be summarised in three major actions:

- Identification of emerging threats 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 (TDA).
- 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 the saltwater 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 assimilators.
- Examine land use and modifications.
- Assess the groundwater quality and assess the aquifer vulnerability to pollution with a view to facilitating their protection.

Underlie a Trans-boundary Diagnostic Analysis (TDA):

- Set up a cooperative institutional and institutional framework to manage the project.
- Strengthen national capacities in groundwater resources management.
- Public awareness and information dissemination.