

SEARCH MODEL FOR DEEP AQUIFERS

Based on experiences from the Kimbiji Aquifer Assessment (KAA) project in Tanzania, a Search Model for deep groundwater resources (aquifers) has been developed for application in other parts of Africa. An outline of the KAA project and Search Model are provided below.

THE KIMBIJI REFERENCE PROJECT, TANZANIA. Dar es Salaam is the largest city and economic engine of Tanzania. Recent years have brought significant and unsustainable growth to the city, and both planners and utilities are struggling to cope with the pressures that accompany urban growth. With an annual population growth rate of nearly 6%, Dar es Salaam is an exceptionally thirsty city, and authorities are in a race to catch up with an asymptotic water demand curve.

Funded by the *Government of Norway*, the KAA project was undertaken to test and verify a deep aquifer concept that had been presented by Fridtjov Ruden in 2005, involving resources literally at the doorstep of Dar es Salaam.

The KAA project¹ was concluded in March 2017. It has verified that the deep aquifer concept is real. Groundwater exploration involving deep (600 m) drilling and testing, and related studies using groundwater modeling tools, have documented that a regional groundwater resource (the Kimbiji Aquifer) is present, with a potential of supplying new and clean water for up to 2 Million people.

RECYCLING OIL SECTOR INFORMATION. Implementation of the KAA project has been a pioneering endeavor. The project bridges the oil and water industries, whereby data and information from the *Tanzanian Petroleum Development Corporation (TPDC)* were used to interpret the architecture and geometry of the deep aquifer system. Without the oil industry data, the task of locating the deep reservoirs of fresh groundwater would not have been possible, since the water sector does not have the resources to investigate at such a scale, and at these depths. Moreover, it would not have been possible to place boundaries on the system or estimate its total thickness and volume. Of relevance to the *Government of Norway*, the oil industry data used for the Kimbiji studies were originally collated by Statoil under a Norwegian programme to build up the TPDC in the late-1970s and early-1980s. In this context, the Norwegian government investments in Tanzania 40 years ago have been recycled under the KAA project to benefit the water sector in Tanzania today. As the KAA project illustrates, the oil sector investments from 40 years ago can be used for other geoscience applications as well, including groundwater exploration and production.

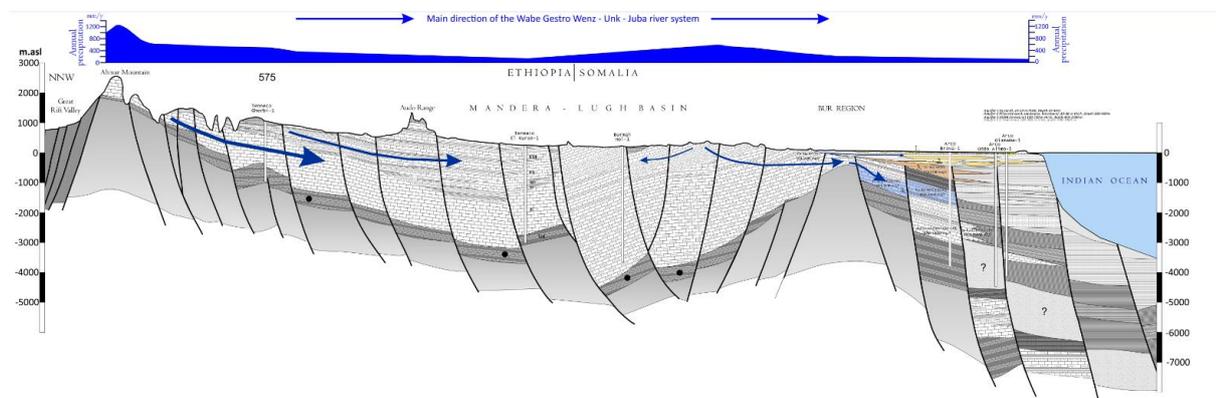
THE SEARCH MODEL. The Kimbiji Aquifer concept² was originally viewed with raised eyebrows by national and regional stakeholders. Like so many other trend-breaking activities (including offshore oil and gas activities), the Search Model is built on sound scientific and technical analyses. Nothing similar had been attempted in Tanzania or East Africa before. However, the results of the KAA project have validated the concept, and initial skepticism has been replaced by expectation. Importantly, the deep aquifer concept and Kimbiji experience can be exported and applied to other regions of Africa, including Somalia.

¹ The KAA project is owned by the *Dar es Salaam Water and Sewerage Authority*. The lead consultancy is *CDM Smith*, an international leader in water resources management, with *Ruden AS*, who developed the early concept and was instrumental in shaping project implementation, from review of oil industry data to supervising field-related activity.

² The initial concept was awarded the *DnB-Nor prize for Sustainability* in 2007, and the *Innovation prize* in 2008, a total of USD 150.000 which helped the development of the early stage of the concept, including a series of scientific publications.

With the exception of the Mediterranean coast, the African continent is fringed by a geological architecture called passive margins, and many locations along the approximately 20.000km African coastline have potential for deep groundwater exploration. The passive margins of Africa have undergone extensive oil and gas investigations in the past 50 years, providing excellent opportunities for exploration of new fresh water resources. *The process of using oil and gas exploration data and information in a deep freshwater context is what we term the Search Model for passive margins.* The potential for water extends at depth along coastlines and under the ocean floor, into environments where the water sector traditionally never ventures. The oil and gas information can, therefore, be recycled and applied in a brand new context.

SOMALIA. The Horn of Africa has potential for deep fresh water prospecting, adhering to the concepts and guidelines on which the Search Model is built. The experiences gained from the KAA and other groundwater exploration projects will consequently be applied to research coastal basins in Somalia as part of a project financed by the Ministry of Foreign Affairs (UD), of Norway.



The potential for deep coastal and fresh groundwater in Somalia are promising. Rainfall in the Ethiopian highlands drain towards Somalia and the geological structures between western infiltration areas and the coastline are conducive for water, ending up in young sedimentary basins which serve as groundwater storage reservoirs. Somalia has been the subject of extensive oil exploration, and the oil sector has produced seismic profiles and deep well logs which would be useful in evaluating the potential for deep water resources beneath the drought-stricken areas of Somalia. The initial challenge is to locate this information and to collate the information into a data repository.

The Norwegian Government last week announced (*Meld.St. 22*) that Somalia will receive support under the auspices of the *Oil for Development* programme. A rational first step of applying the Search Model would be to develop and safeguard a *national* data repository. This is where earlier investments in information would be kept, not just for oil and gas, but also for other subsurface resources, including fresh water. Opportunity exists to use the information in a common effort to provide water, food and energy for Somalia – this time, by going for exploration and sustainable exploitation of potentially massive underground reservoirs. In light of the ongoing drought, there is no time to lose.

THE TEAM BEHIND THE SEARCH MODEL. With a total of 230 years of experience in science and technology-based international oil, gas and water prospecting sectors, the 6 member team behind the *Search Model* is currently working as a dedicated group of professionals, under the name *iDAI* (*Integrated Deep Aquifer Initiative*). The current host company is Ruden AS, based in Engelsviken, Norway.

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