PHOTO ALBUM

KARST OF HORN OF AFRICA

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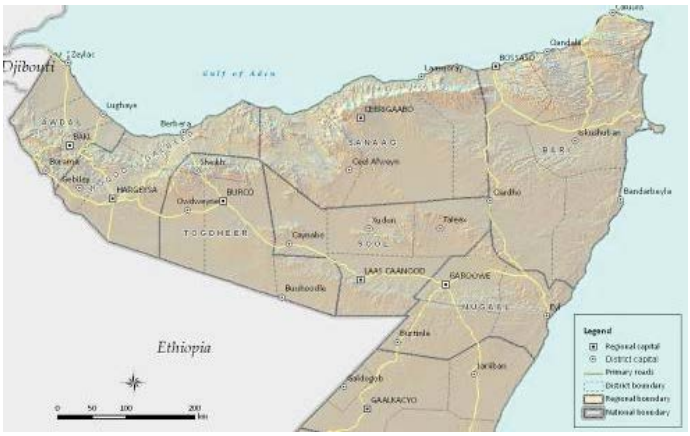
KARST OF NORTHERN SOMALIA



The main objective of SWALIM Phase IV / HASP was groundwater assessment of the northern part of Somalia and the creation of a base for its sustainable use and development. Most of the study area depends exclusively on groundwater which is the sole resource during dry seasons (no perennial streams present). Although many activities in drilling and groundwater provision have been undertaken in the past, no systematic research, classification of aquifer systems or evaluation of resources have been done up to this HASP.

Out of nine differentiated hydrogeological units in the study area, four are most promising for further development and groundwater utilization, and three of them are karstic. Those are: Major Togga'a alluviums (intergranular aquifer of Quaternary age), Jurassic limestones (karstic aquifer), Auradu limestones (karstic aquifer of Lower Eocene age), and Karkar limestones (karstic aquifer of Upper Eocene).

Eocene Karkar limestones (Ek) represent the most prospective fresh groundwater reservoir for further development in the central and eastern parts of the study area (Sool and Hawd plateaus). The quality of water from springs and wells is relatively fresh with an EC value of 490 to 1800 micromhos/cm. But the practical problem is the variable thickness of the Karkar, the percolation towards underlying Taleex evaporitic rocks and often present groundwater mixture of the two aquifers.

The Taleex Series (Et) are formed in typical arid climate conditions. The evaporitic rocks (gypsum, anhydrites, limestones, dolostones) usually yield moderate to highly mineralized groundwater. The Ca or $CaSO_4$ type of water prevails with TDS usually greater than 3800 mg/l.

[1] Zoran Stevanović, Saša Milanović, Branislav Trivić and few other international consultants worked in 2011-2012 on hydrogeology assessment of the two northern provinces of Somalia: Somaliland and Puntland (HASP) under the Phase IV of Somalia Water and Land Information Management SWALIM (FAO, Nairobi, Kenya). All information collected from the hydrogeological and geophysical field survey, remote sensing, chemical analyses and parameters determined *in situ*, and groundwater monitoring was posted into the new GIS Geo database. One of the main outputs of HASP is the Regional Hydrogeological Map of the study area adapted to the scale 1:750,000. Along with this map, several other thematic maps and GIS layers are also created and today represent a part of SWALIM Geo database. Some of the main HASP outputs include the first ever classification of local aquifer systems and groundwater resources assessment (both quantity and quality) of selected areas, the selection of promising areas for further groundwater development, the establishment of an initial groundwater monitoring network, and a proposal for regulation measures of aquifer and sustainable use of groundwater. The study is available for download at http://www.faoswalim.org/water_reports.
Presented photos are made by authors of this section, but also partly by SWALIM field staff during the extensive survey conducted in the region.

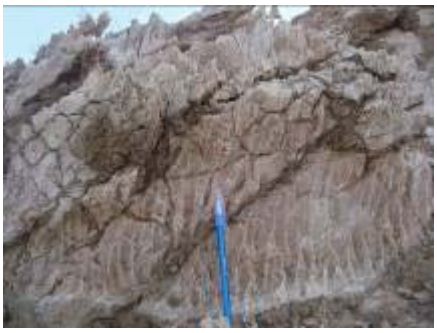
groundwater. The Ca or $CaSO_4$ type of water prevails with TDS usually greater than 3800 mg/l. Many boreholes were abandoned because of a high salinity content not fit for human consumption.

The Auradu limestones (Ea) are also very promising aquifer as they may yield water of good quality. If present, the overlying Taleex aquifer must be sealed off in order to secure tapping of fresh water. The chemical analyses of groundwater from wells tapping the Auradu limestones show a bicarbonate type of water with low mineralization, and with an EC value generally below 1000 micromhos/cm.

The Jurassic limestones have the greatest potential for groundwater development of any rock type. Observations made in the study area indicate that this rock should be a significant aquifer where it is fractured or has undergone extensive karstification development. The most extensive karst development is in the study area near Borama city which utilize these karstic waters in a large extent.

Cavern carved in Taalex's karstified gypsum (Sool Plateau near Xudun)

Gypsum layers of Taleex Fm.



Recording data on spring issued from Karkar Fm. (near Buhoodle; Photo Puntland team 2)

Collapsed roof of the cavern is creating a sinkhole (left, photo Puntland team. The cave carved in Karkar limestones (right, Buuhoodle area)

Pothole and small pond in evaporitic rocks of Taleex Fm.

Sinkhole used for tapping groundwater

Hayasee spring from Taalex Fm. in Ceel Afweyne area, predisposed by the fault which also cut a narrow and steep valley (Photo Somaliland team 2)

Meer Meer pothole in Auradu limestones (Ceerigabo)

Natural pothole with groundwater on its bottom in Taleex evaporitic rocks. The artificially made stairs facilitate access to single available water source in the area (Photo Somaliland team 2)

Extracting groundwater from shallow and deep wells is the main kind of water supply. The well is dug out in delluvial material in the Karkar Fm. foothill (Buuhoodle,)