HYDROGEOCHEMICAL CHARACTERISTIC OF GROUND WATER IN THE TURKANA COUNTY (AFRICA)

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Introduction

Turkana is the largest county situated on the northwestern part of Kenya. It covers 77 thousands km^2 and constitutes about 43% of the total area of Rift Valley Province. This county includes a Turkana Lake which is a natural eastern boundary of this region. Turkana is split into 6 districts: Turkana North, Turkana West, Turkana Central, Loima, Turkana East and Turkana South. Turkana is the poorest region in Kenya with frequent droughts and famines problem. One of the major problem beside famines that people face are drought that recur every 2-4 years. It implies the water sources are dried and number of points that water can be drawn decreases and the epidemics of water-borne disease among people and animals break out (Oduor et al., 2012). In this research there is presented hydrogeochemical characteristic of groundwaters collected in several villages over the years (Figure 1).

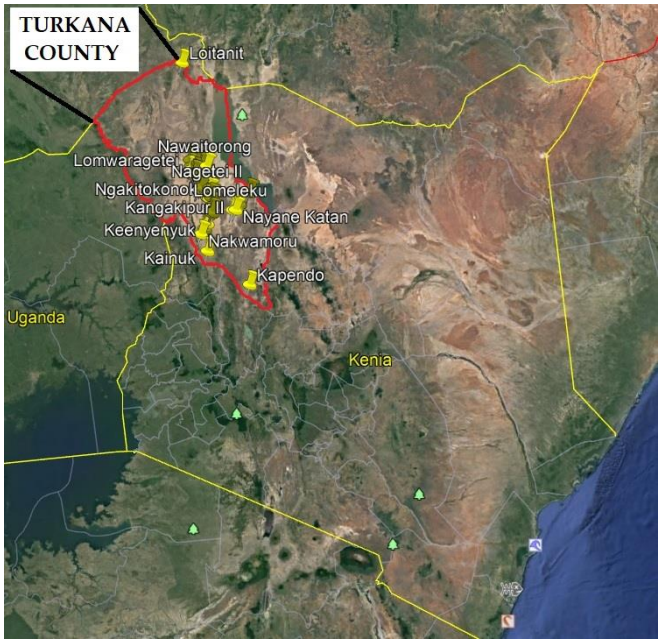


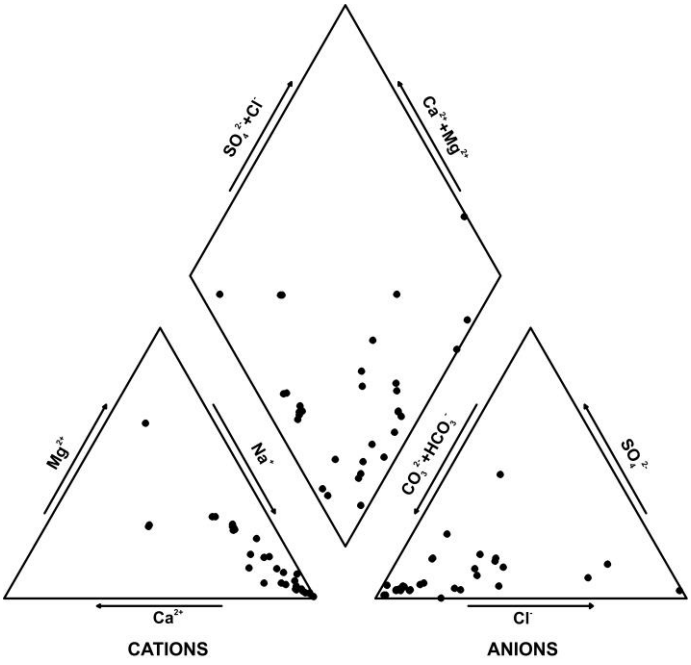
Figure 1. *Localization of the Turkana County and groundwater sampling points.*

Samples and methods

Monitoring network consist of 36 points scattered throughout the County from which groundwater was collected in years 2004-2016.. The water bearing material was different and included both volcanic, sedimentary and metamorphic rocks. The depth of the wells was from 17 to 80 meters below surface and there were recognized two waters struck in few cases. The data used for the research purposes was achieved from the Government Chemist's Department of the Republic of Kenya. The reports of the chemical analyses did not include the methods of analysis therefore they were not presented in this paper. The hydrogeochemical characteristics contain chemical analyses check with the ionic balance error (Macioszczyk, 1987), calculation of the mineralization based on the major ions (Ca^{2+}, Mg^{2+}, Na^{+}, K^{+}, Cl^{-}, HCO_3^{-} and SO_4^{2-}) and indication of the hydrochemical type of water.

Results

The ionic balance error was calculated for 33 points due the lack of data in case of waters collected in: IDP Camp Nakwamekwi, Kengerisai and Loitanit. These point were excluded from further analysis. For almost all samples calculated the ionic balance was correct beside few ones what can be affected by the analytical methods used or physical parameters interfering the measurements. Calculated mineralization of the groundwaters collected is from 471.4 to 26 413 mg/L. The analyzed waters can be classified in range from fresh to mineral waters in accordance with hydrogeological classification of Pazdro&Kozerski (1990). As the Piper's Diagram shows, groundwater samples collected (Figure 2) are mainly bicarbonate-(chloride/potassium)-sodium-(magnesium), sulphates-bicarbonate-sodium-(magnesium) using Szczukariew-Prikłoński classification (Macioszczyk, 1989).



Beside the major ions there were also determined additional chemical parameters i.e.: NO_2^-, NO_3^- or F^-. The last one constitutes the main problem due to high concentrations in analyzed waters. In 13 points the concentration of F^- exceeds the WHO (2011) guideline value of 1.5 mg/L. It is a crucial information considering analyzed water for drinking purposes. Concentrations above this value and much higher lead to skeletal fluorosis what is another problem met in the Turkana County.

Figure 2 *Hydrogeochemical characteristics of groundwater using the Piper's Diagram.*

Conclusions

Based on the shortened hydrogeochemical characteristics, groundwaters in the Turkana County are low-mineralized to high mineralized which can provide a local people good quality of drinking water during periods of drought after thorough examination of its inorganic and organic parameters or after a proper treatment or can be used for domestic purposes. However the chemical composition should be periodically controlled due to the elevated concentrations of fluorides.

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