Contribution ID: **150** Type: **Poster**

Characterizing Natural Radioactivity Systematics in Lake Magadi Basin Geothermal System in Relation to Quality of Trona Deposits

The Magadi endorheic basin of Kenya is characterized by high heat flows due to magmatic activity, extremely saline geothermal manifestations, and vast deposits of trona in Lake Magadi. The basin is located in the southern part of the Kenya Rift Valley; an arid volcano-active continental rift that is part of the East African Rift Valley system. Lake Magadi lies to the south of the basin and is recharged mainly by highly alkaline geothermal springs around it. Being endorheic, the lake depends entirely on evaporation for hydrogeological balance. This makes the lake a natural sink for radiopollutants from the surrounding geothermal activities. We measured activity concentrations of 40K, 238U (226Ra), 232Th, and 210Pb and performed multivariate exploratory characterization of the radionuclides in relation to the modulating physico-chemical parameters (spring temperature, pH, s.g., TDS, TOC, Na2CO3, NaHCO3 and NaCl) of the Magadi basin, in relation to their sources and quality of trona mined from the lake. This was realized via HPGe based gamma-ray spectrometry of trachyte rock, thermal water, sediments and raw trona from the basin as well as of processed soda ash and cattle salt from the Magadi Soda Company. The radionuclide activity concentrations and gamma spectra of the samples were analyzed using PCA, HCA and CT. The mean activity concentrations of K-40, U-238 and Th-232 radionuclides in Bq/Kg were 1614±14.0, 162.3±13.5 and 120.1±15.1 respectively in rocks, 1875.8±10.8, 131.2±9.9 and 188.2±5.6 respectively in sediments and 127.6±21.7, 41.7±22.3 and 55.9±17.8 respectively in thermal water samples. K-40 and Th-232 were found to be accumulating within the Magadi basin with enrichment coefficients of 1.2 and 1.6 respectively. Three regimes of alkaline spring inflows were found to affect the quality of trona deposits in Lake Magadi and were delineated based on their radionuclide activity concentrations, feature selected gamma spectral signatures and solute content. They are: Na2CO3- and NaCl- rich inflows from the south; NaHCO3-rich inflows from the north; and saline fluid inflows from the bedrock bounding the western edges of the lake. Statistical analysis showed log normal distribution of the radionuclides in the basin, probably due to different radionuclide signatures of the spring recharges. PCA, HCA and CT analysis of the radionuclide levels and distributions in relation to thermal water temperatures, pH, TDS, TOC, and sediment CEC revealed marked diversity in the geochemical properties of the source rocks responsible for the spring solutes.

Primary authors: Prof. KALAMBUKA, Hudson Angeyo (University of Nairobi); Mr TAMBO, Paul (University of Nairobi)

Presenter: Prof. KALAMBUKA, Hudson Angeyo (University of Nairobi)

Session Classification: Session IV - Characterization in Industrial Facilities and in the Environment

Track Classification: NORM Characterization, Measurement, Decontamination