GEOCHEMICAL ASSESSMENT USING RADON AND CARBON DIOXIDE CONCENTRATION LEVELS FROM SOIL GAS SURVEY, CASE STUDY OF MORENDAT EAST GEOTHERMAL PROSPECT, KENYA

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INTRODUCTION

• The Ministry of Energy and Petroleum, Kenya has developed strategies for exploration and development of geothermal energy resources in the country, mainly along the East African Rift.

• Detailed surface geo-scientific investigations are carried out using various methods before a field is committed for exploration drilling and finally steam field development.

• The Ministry of Energy and Petroleum also undertakes its own geothermal resource assessment of prospective areas for purposes of ranking them.
OBJECTIVES

• To locate permeable zones and infer the presence of possible heat source linked to an active geothermal system.

• To rank the prospect and facilitate its development by the private sector.
GEOLOGY AND STRUCTURES

• The rocks of Morendat East area mainly fall in to two main categories namely; Lacustrine /alluvial deposits, Lavas and pyroclastics.

• From previous geological studies, radiocarbon dating of specific layers/ volcanic products attributes this area to be dormant rather than extinct hence emphasize a continued presence of shallow heat sources.

• Major faults are longitudinal to the Rift System while minor ones trending east – west in this prospect.

• Lacustrine sediments and pyroclastics which have been deposited subaqueously in this prospect, consist of thermally insulating thick blankets of sediments covering basement rock and having relatively low-normal heat flow hence sealing geothermal system as a cap rock.
MATERIALS AND METHODS

• Soil gas survey has been applied in geothermal areas during the surface geochemical studies.

• The CO$_2$ gas was measured as % of the total gas using the Orsat gas sampling apparatus.

• Radon counts were measured using the portable RAD 7 equipment.
• An infra-red thermometer was used to take the soil temperature.
RESULTS

• From the sampling survey, a total of 100 points were sampled, for the construction of the contour maps indicating the distribution and concentration of radon, CO$_2$ and temperature.

• Factorial Kriging Analysis (F.K.A) method since the data was concentrated around a certain specific region due to inaccessibility.

• This method was also going to put into consideration the spatial features in the area by overlaying the contour maps.
Radon Distribution Contour Map
CO2 Distribution Contour Map
Temperature Distribution Contour Map
DISCUSSION

• The radon counts range between a low of 0 cpm and a high of 2834 cpm indicating the lava covered areas and the prospective permeable areas respectively.

• The %CO₂ distribution in the area ranges between 0-5.4 percent, this is a probable primary way to locate permeable zones and infer the presence of possible heat source linked to an active geothermal system.

• Possible faults were inferred north of the prospect area due to the anomalously high levels of CO₂ and ²²⁰Rn recorded.
CONCLUSION

• The high radon counts were associated with the highly fractured area and a high heat flux.

• The spatial pattern of the CO$_2$ flux anomalies as well as Rn soil-gas distribution suggest a structural control on diffuse degassing; in particular, along and near the fault floors.

• The Morendat East geothermal prospect indicated satisfactory permeability features which was linked to a possible active heat source hence should be ranked for further exploration.
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