The Malawi Rift is located in the Eastern Basin of the East African Rift System (EARS), which has potential for geothermal energy generation. Previous geothermal studies in Malawi focused on the geochemistry of hot springs and the occurrence of hot springs. The most promising areas for continued exploration are the Honolulu hot springs in southern Malawi and the Mphizi hot springs.

The hot springs were analyzed for the major cations and anions (Na, K, Ca, Mg, Cl, SO\(_4\), and HCO\(_3/\)CO\(_3\)) and stable isotopes. The pH, surface temperature, electrical conductivity, and total dissolved solids (TDS) were measured in the field. The stable isotope of \(\delta^2\)H against \(\delta^{18}\)O shows the relationship in Larderello, Italy and Wairakei, New Zealand. Higher ratios of Cl / (HCO\(_3\) + CO\(_3\)) suggest hotter aquifers (Fournier, 1977). Mass balance studies of Mphizi hot springs. The Cl / (HCO\(_3\) + CO\(_3\)) ratios are useful to identify waters from different aquifers (Fournier & Truesdell, 1970). The Na-K geothermometers show the highest reservoir temperature results. The Na-SO\(_4\) geothermometers show the highest temperature results. The Na-HCO\(_3\) geothermometer results are unreliable. The northern part of the Malawi Rift has the most prominent areas (Kamposny) for geothermal energy development. The geothermal systems in Malawi are related to meteoric water infiltrated at depth through highly permeable and deep faults. The meteoric water is heated by shallow geothermal gradient or volcanic waters related to rifting processes. The geothermal fluid (Na-Cl) moves through faults and produces such as water-rock equilibrium, boiling, heating by steam (Na-SO\(_4\)), and mixing with shallow aquifers (Na-HCO\(_3\)) occurring during the ascent.

REFERENCES

- Fournier RO, Potter RW (1982) Revised and expanded silica (quartz) geothermometer Bull, Geotherm Resour Counc (Davis, Calif); (United States) 11.

Figure 1 A. Territorial setting of the East African Rift System showing the Eastern and Western branches and the Malawi Rift. The Malawi Rift is a left-lateral strike-slip fault, which is a left-lateral transform fault located in the Eastern Basin of the East African Rift System (EARS), which has potential for geothermal energy generation. Previous geothermal studies in Malawi focused on the geochemistry of hot springs and the occurrence of hot springs. The most promising areas for continued exploration are the Honolulu hot springs in southern Malawi and the Mphizi hot springs.

Figure 2 A. Bicarbonate water type is associated mainly with meteoric waters from shallow aquifers in Malawi’s hot springs. The stable isotope of \(\delta^2\)H against \(\delta^{18}\)O shows the relationship in Larderello, Italy and Wairakei, New Zealand. Higher ratios of Cl / (HCO\(_3\) + CO\(_3\)) suggest hotter aquifers (Fournier, 1977). Mass balance studies of Mphizi hot springs. The Cl / (HCO\(_3\) + CO\(_3\)) ratios are useful to identify waters from different aquifers (Fournier & Truesdell, 1970). The Na-K geothermometers show the highest reservoir temperature results. The Na-SO\(_4\) geothermometers show the highest temperature results. The Na-HCO\(_3\) geothermometer results are unreliable. The northern part of the Malawi Rift has the most prominent areas (Kamposny) for geothermal energy development. The geothermal systems in Malawi are related to meteoric water infiltrated at depth through highly permeable and deep faults. The meteoric water is heated by shallow geothermal gradient or volcanic waters related to rifting processes. The geothermal fluid (Na-Cl) moves through faults and produces such as water-rock equilibrium, boiling, heating by steam (Na-SO\(_4\)), and mixing with shallow aquifers (Na-HCO\(_3\)) occurring during the ascent.

Structural geology analysis should be conducted to better understand the fluid flow, and pathways through faults.

Figure 4 A. Scattering diagram plotting silica concentration against quartz geothermometer temperatures for waters cooled by adiabatic expansion. The Na-K geothermometers show the highest reservoir temperature results. The Na-SO\(_4\) geothermometers show the highest temperature results. The Na-HCO\(_3\) geothermometer results are unreliable. The northern part of the Malawi Rift has the most prominent areas (Kamposny) for geothermal energy development. The geothermal systems in Malawi are related to meteoric water infiltrated at depth through highly permeable and deep faults. The meteoric water is heated by shallow geothermal gradient or volcanic waters related to rifting processes. The geothermal fluid (Na-Cl) moves through faults and produces such as water-rock equilibrium, boiling, heating by steam (Na-SO\(_4\)), and mixing with shallow aquifers (Na-HCO\(_3\)) occurring during the ascent.

The Na-Cl waters in Malawi may be related to groundwater in partial equilibrium with the rock and heated by steam from deeper reservoirs. Similar systems occur in the Basin and Range Province of the U.S., which are controlled by geological structures such as normal faults. The basin is a series of grabens and half-grabens that form a system of the Basin and Range Province of the U.S. similar to those in Malawi.

Figure 4 B. Scatter diagram plotting silica concentration against quartz geothermometer temperatures for waters cooled by adiabatic expansion. The Na-K geothermometers show the highest reservoir temperature results. The Na-SO\(_4\) geothermometers show the highest temperature results. The Na-HCO\(_3\) geothermometer results are unreliable. The northern part of the Malawi Rift has the most prominent areas (Kamposny) for geothermal energy development. The geothermal systems in Malawi are related to meteoric water infiltrated at depth through highly permeable and deep faults. The meteoric water is heated by shallow geothermal gradient or volcanic waters related to rifting processes. The geothermal fluid (Na-Cl) moves through faults and produces such as water-rock equilibrium, boiling, heating by steam (Na-SO\(_4\)), and mixing with shallow aquifers (Na-HCO\(_3\)) occurring during the ascent.

The Basin and Range Province of the U.S., which are controlled by geological structures such as normal faults. The basin is a series of grabens and half-grabens that form a system of the Basin and Range Province of the U.S. similar to those in Malawi.

Figure 5 A. Ternary diagram K-Mg-Na geothermometer by Giggenbach (1988) showing estimated reservoir temperatures and the immature or partial equilibrium water fields. Geothermometry of hot springs in the Malawi Rift

Figure 6 A. Scatter diagram showing Cl / (HCO\(_3\) + CO\(_3\)) ratios plotted against silica for the three types of water composition in Malawi’s hot springs. The stable isotope of \(\delta^2\)H against \(\delta^{18}\)O shows the relationship in Larderello, Italy and Wairakei, New Zealand. Higher ratios of Cl / (HCO\(_3\) + CO\(_3\)) suggest hotter aquifers (Fournier, 1977). Mass balance studies of Mphizi hot springs. The Cl / (HCO\(_3\) + CO\(_3\)) ratios are useful to identify waters from different aquifers (Fournier & Truesdell, 1970). The Na-K geothermometers show the highest reservoir temperature results. The Na-SO\(_4\) geothermometers show the highest temperature results. The Na-HCO\(_3\) geothermometer results are unreliable. The northern part of the Malawi Rift has the most prominent areas (Kamposny) for geothermal energy development. The geothermal systems in Malawi are related to meteoric water infiltrated at depth through highly permeable and deep faults. The meteoric water is heated by shallow geothermal gradient or volcanic waters related to rifting processes. The geothermal fluid (Na-Cl) moves through faults and produces such as water-rock equilibrium, boiling, heating by steam (Na-SO\(_4\)), and mixing with shallow aquifers (Na-HCO\(_3\)) occurring during the ascent.

The Basin and Range Province of the U.S., which are controlled by geological structures such as normal faults. The basin is a series of grabens and half-grabens that form a system of the Basin and Range Province of the U.S. similar to those in Malawi.

Figure 7 A. Ternary diagram K-Mg-Na geothermometer by Giggenbach (1988) showing estimated reservoir temperatures and the immature or partial equilibrium water fields. Geothermometry of hot springs in the Malawi Rift

Figure 8 A. The Na-KCl-Ca diagram plot by Giggenbach and Giggenbach (1988), a useful tool to determine geothermal system temperatures (Giggenbach & Glover, 1992). Such composition, i.e., “pipe diagram,” and used to assess the activity of different parts of geothermal systems.