High-enthalpy reservoir indications in Mbeya area (SW Tanzania) revealed by magnetotelluric measurements

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In Mbeya area, SW Tanzania, two geothermal systems have been distinguished by geochemical results (Kraml et al., this volume). The Northern system is thought to be related to the Ngozi volcano feeding Songwe and other hot springs. Geothermometry implies reservoir temperatures above 200 °C for this Northern system.

Electrical conductivity of the subsurface is usually one indicative parameter for geothermal resources. Due to the high temperatures of above 200 °C close to the Ngozi volcano alteration products (smectite) and highly mineralised waters may contribute to high conductivities at various depths.

Magnetotelluric soundings have been recorded at 14 locations and 2-dimensionally inverted to yield conductivity-depth information down to 10 km. At shallow depth (1000 - 500 masl) the modelled resistivity structure show laterally good conductive layers, fingering out along the groundwater flow direction. In the shallowest part the good conduction may be attributed to highly mineralised waters whereas at increasing depth hydrothermal alteration may be the cause. Further down conductivities decrease slightly.

The encountered succession of low-high-low conductivities is indicative for geothermal high-enthalpy reservoirs due to hydrothermal alteration zoning. High smectite abundance is generated in the temperature range from 100 °C to 180 °C, frequently forming an extremely well conducting clay cap above the reservoir. In the reservoir temperatures exceed 200 °C, thus smectite abundance decreases there, as well do conductivities. From this scenario an approximate location and depth to the reservoir of 2200 m (275 mbsl) may be estimated from the magnetotelluric conductivity models.

At greater depth around 2000 mbsl the major NW-SE rift trend can be distinguished by its conductivity structure.

To further enhance the certainty of lateral and depth extension of the assumed reservoir additional magnetotelluric measurements are proposed towards the Southern extension of the anomaly structure found.

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