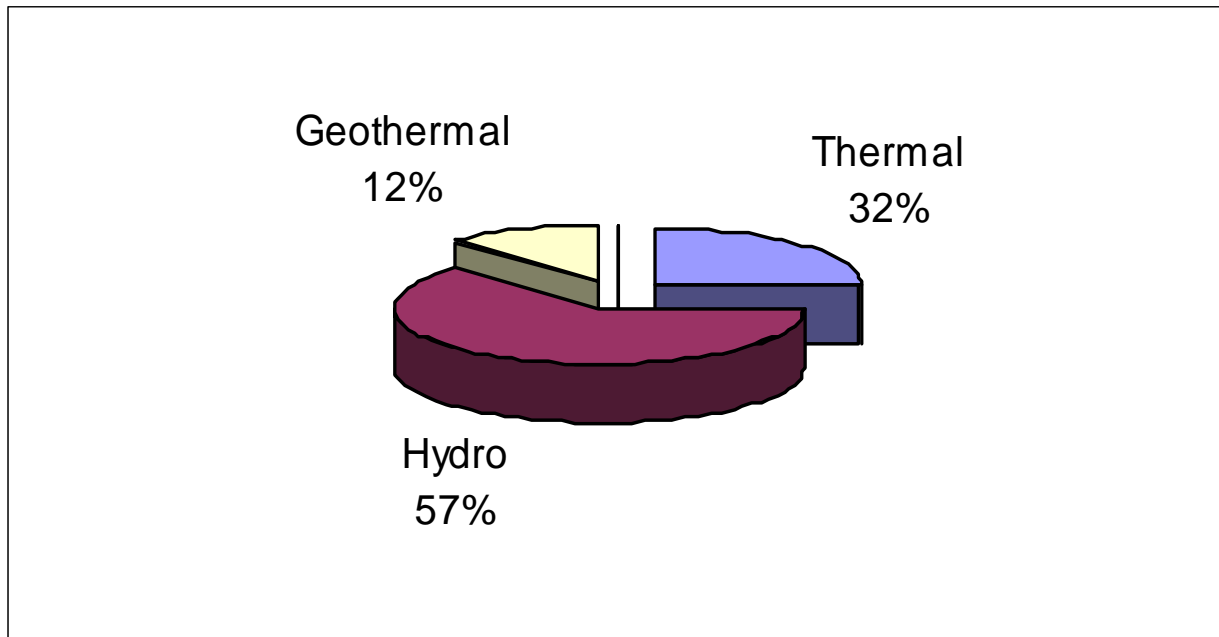


Geothermal Potential of the Kenya Rift: energy estimates based on new data

Peter Omenda and Silas Simiyu
KenGen

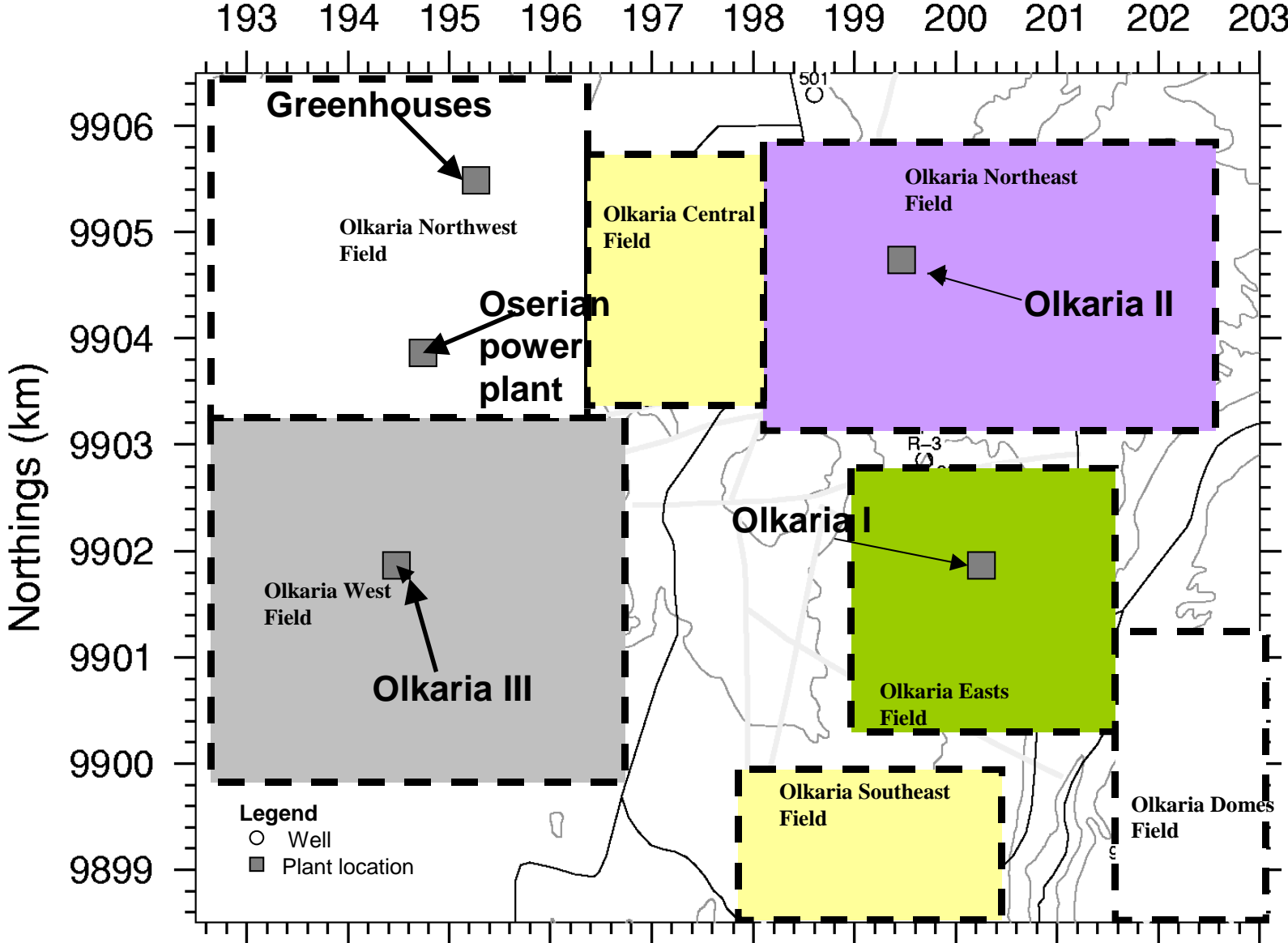
Introduction

- Kenya relies on three major sources of energy in the electricity sub sector:
 - Hydropower (57 %)
 - Fossil based thermal (32 %)
 - **Geothermal (12 %).**



Olkaria Fields

Eastings (km)



Geothermal Installations

- Four Power plants have been installed at Olkaria, namely:

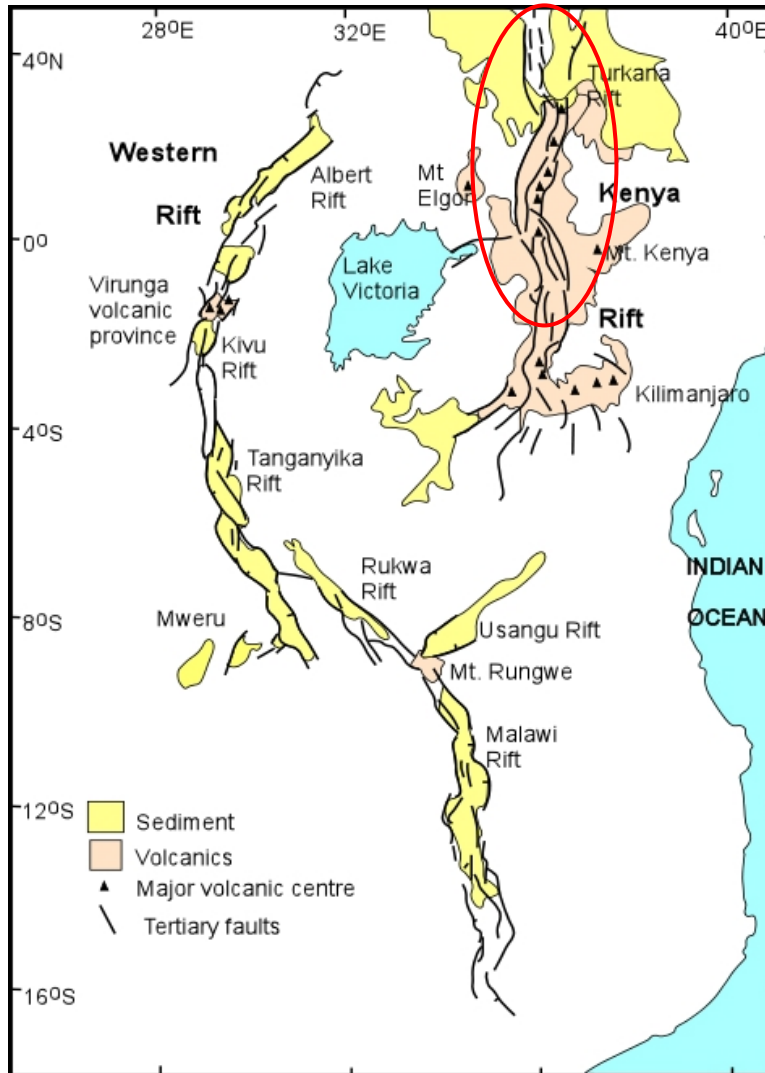
	<u>Current</u>
– Olkaria I	45 MW
– Olkaria II	70 MW
– Olkaria III	13 MW
– Oserian	2 MW
Total	<u>130 MW</u>



Immediate additional Installations (By 2010)

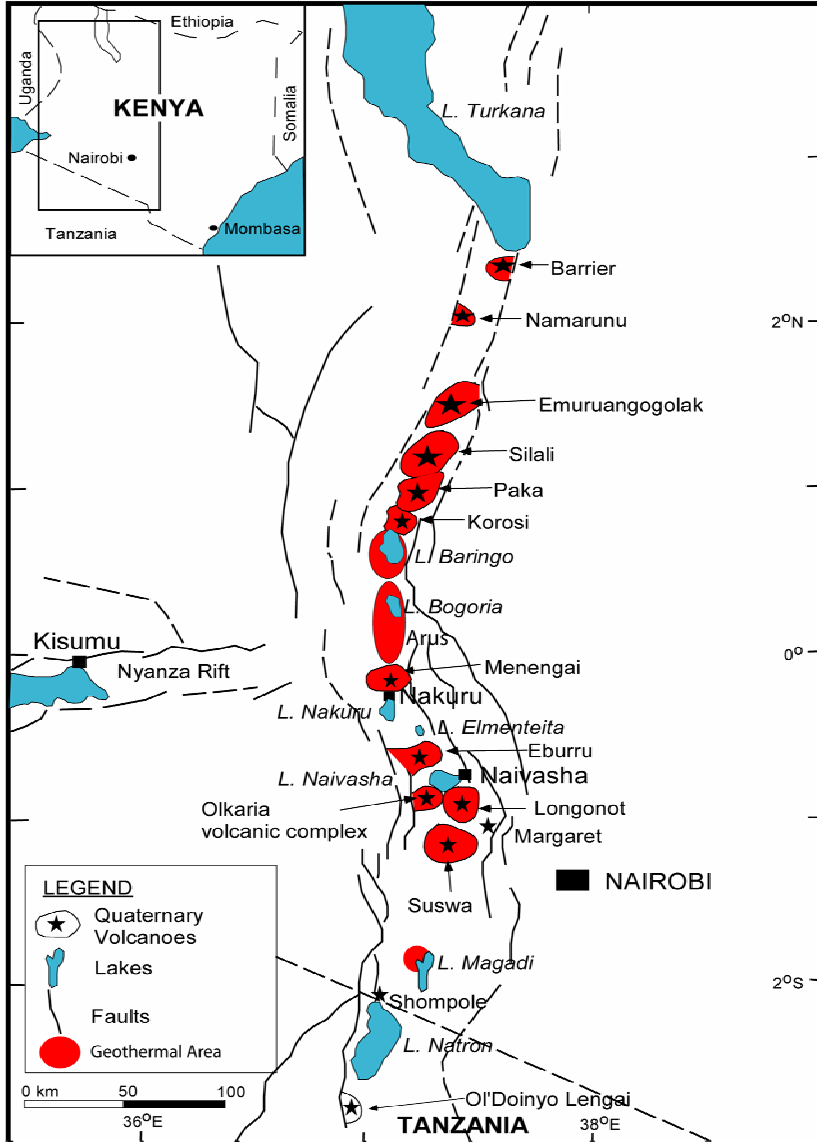
• Olkaria II Extension	35 MW
• Olkaria III Expansion	24 MW
• Olkaria IV Development	70 MW
• Eburru Development	2.5 MW
• Oserian II	2 MW
Total	133.5 MW

Geothermal Occurrence in Kenya



- Geothermal areas are located within the Kenya Rift
- Rift has been magmatically active since 25 Ma.
- Last magmatic activity occurred few hundred years ago

High Temp Geothermal Areas



- 14 high temp geothermal areas identified in the rift
- 130 MW at Olkaria
- Exploration drilling has been done at Eburru
- Detailed surface studies done on 7 others

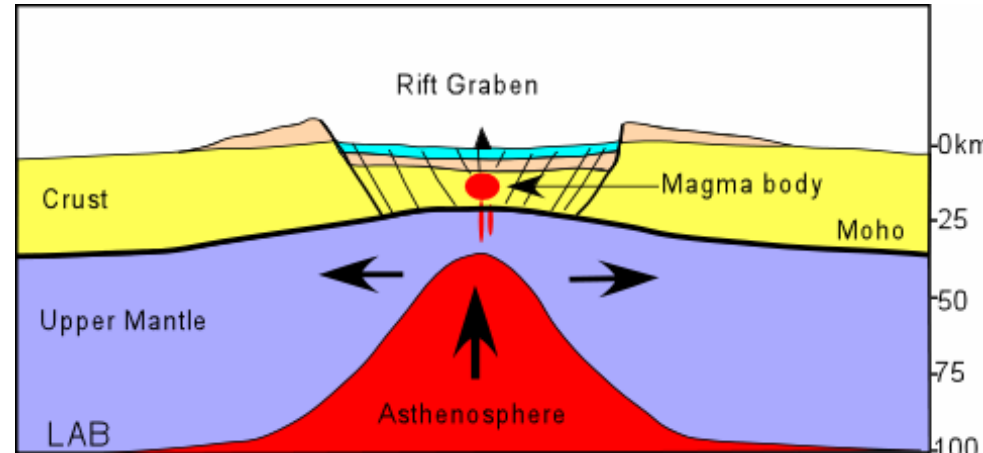
Resource assessment

- Mainly volcano (caldera) hosted systems
- Based on Olkaria experience
 - 30-35 MW/km²
 - Centralized heat sources
 - Similar permeability/hydrological structure

Heat Sources

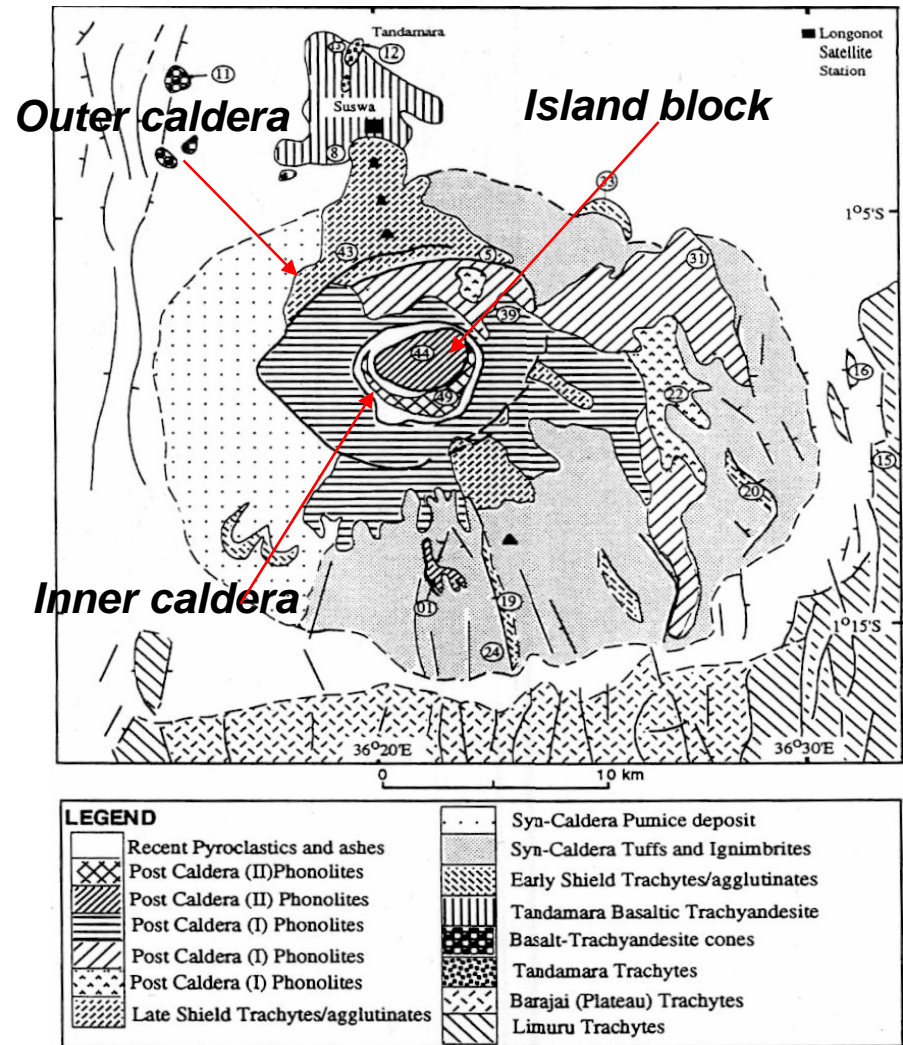
As imaged by gravity, seismics and geological models

- Shallow magma bodies:
 - magma chambers (5-10km)
 - Dike swarms
- High geothermal gradient:
 - Thin crust (20-30km)
 - Upwelling mantle (50 km)



Suswa volcano

- Late Pleistocene caldera volcano
- Geothermometry temp $>300^{\circ}\text{C}$

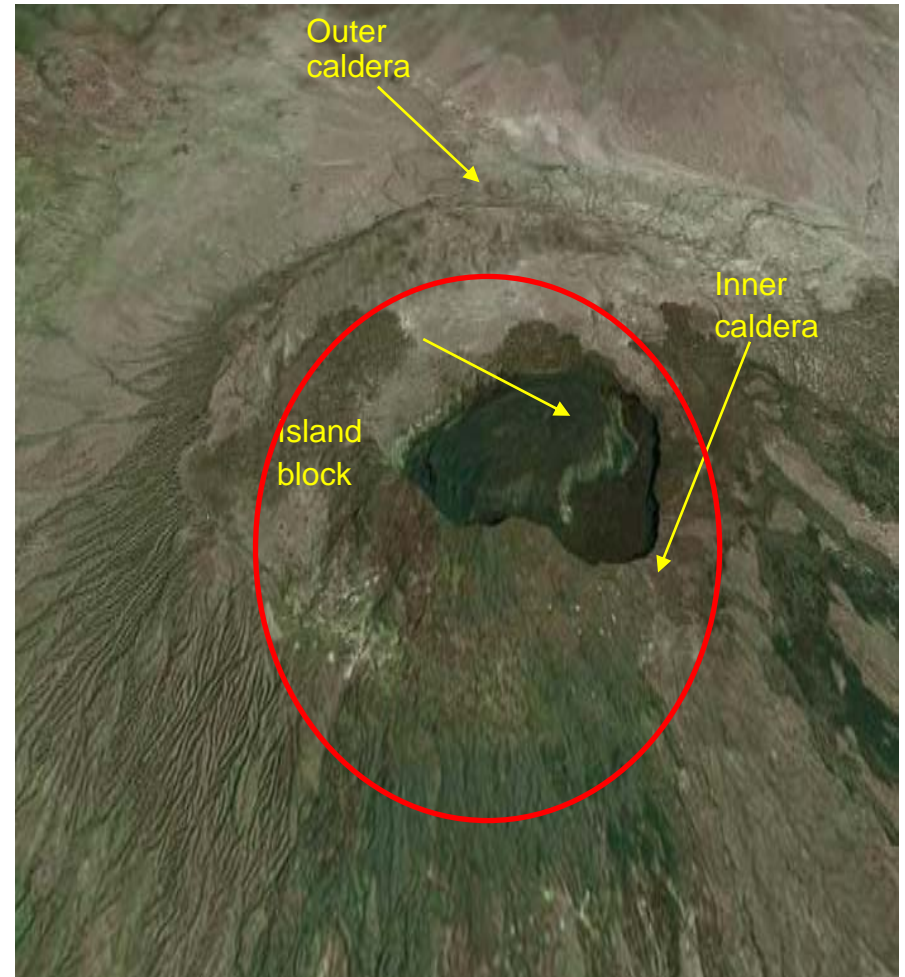


Suswa caldera

KenGen

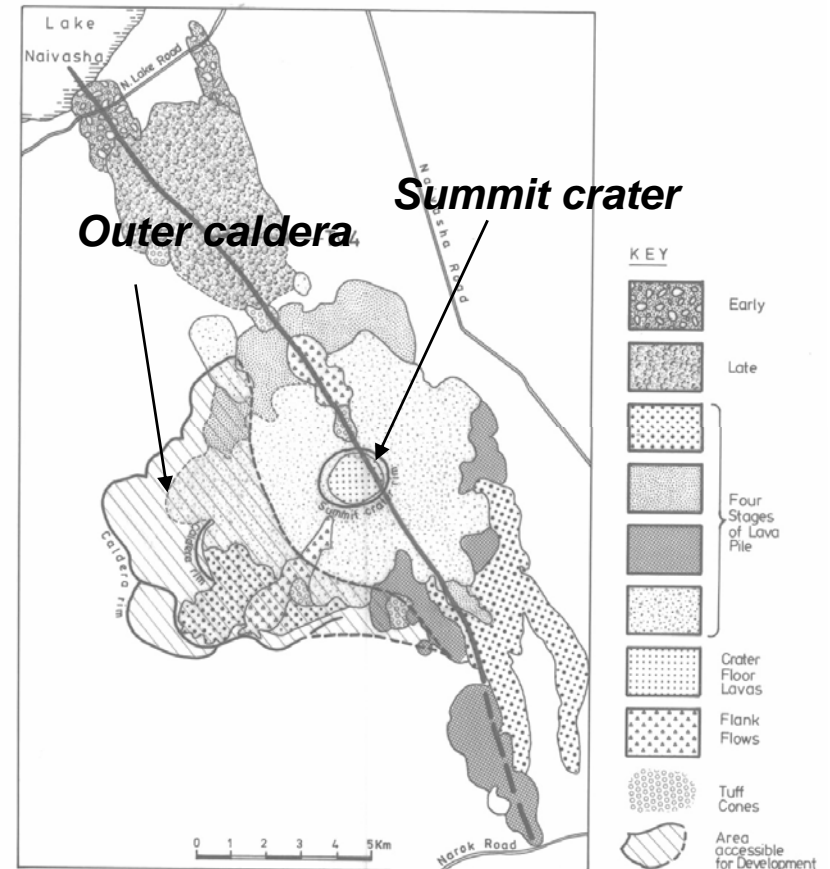
Suswa volcano

- Low resistivity anomaly (15-20 ohm-m) within the caldera
- Power potential is estimated to be over 2-400 MW



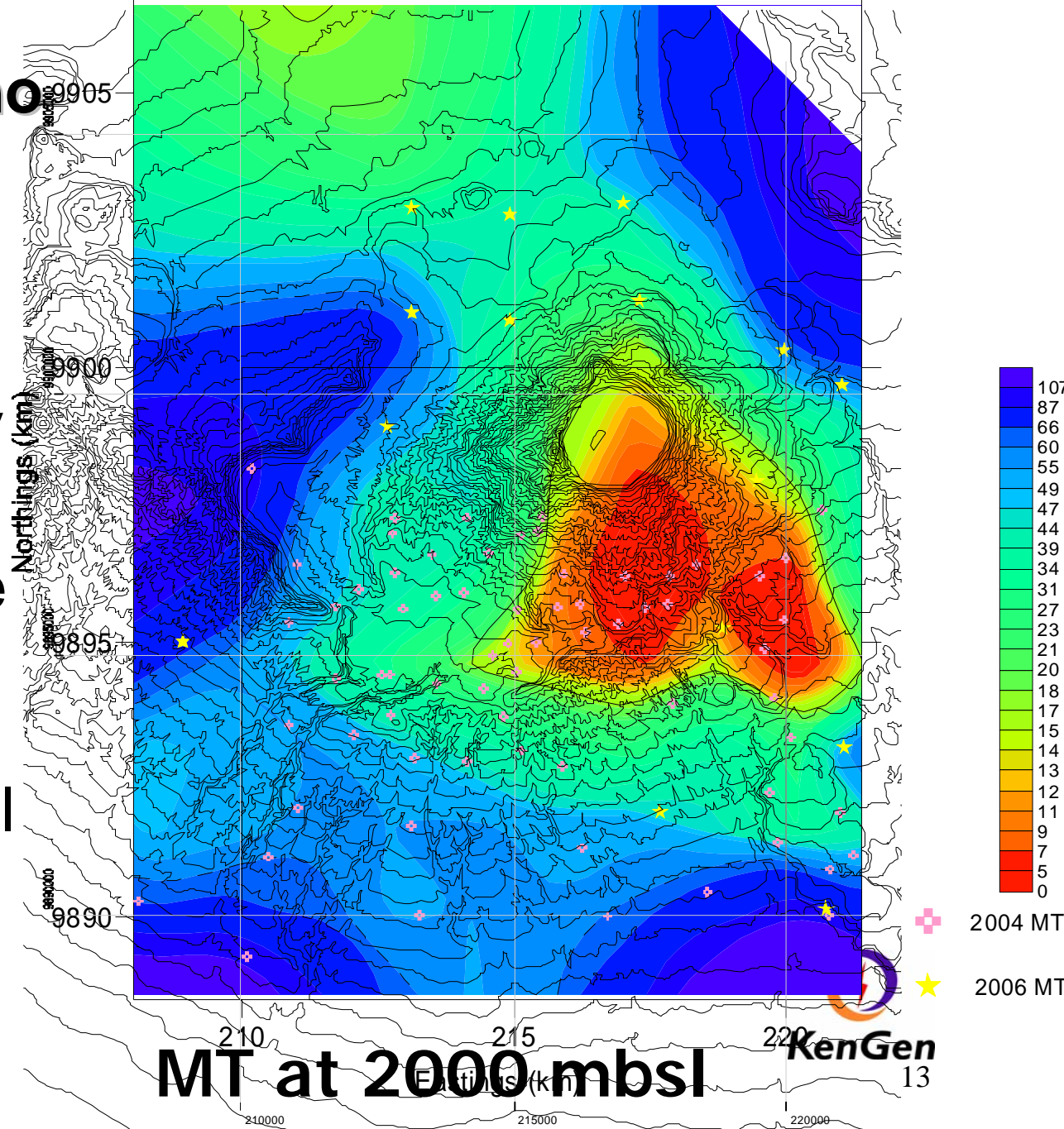
Longonot volcano

- Large caldera volcano and a summit crater
- Youngest activity less than 300 yr BP



Longonot volcano

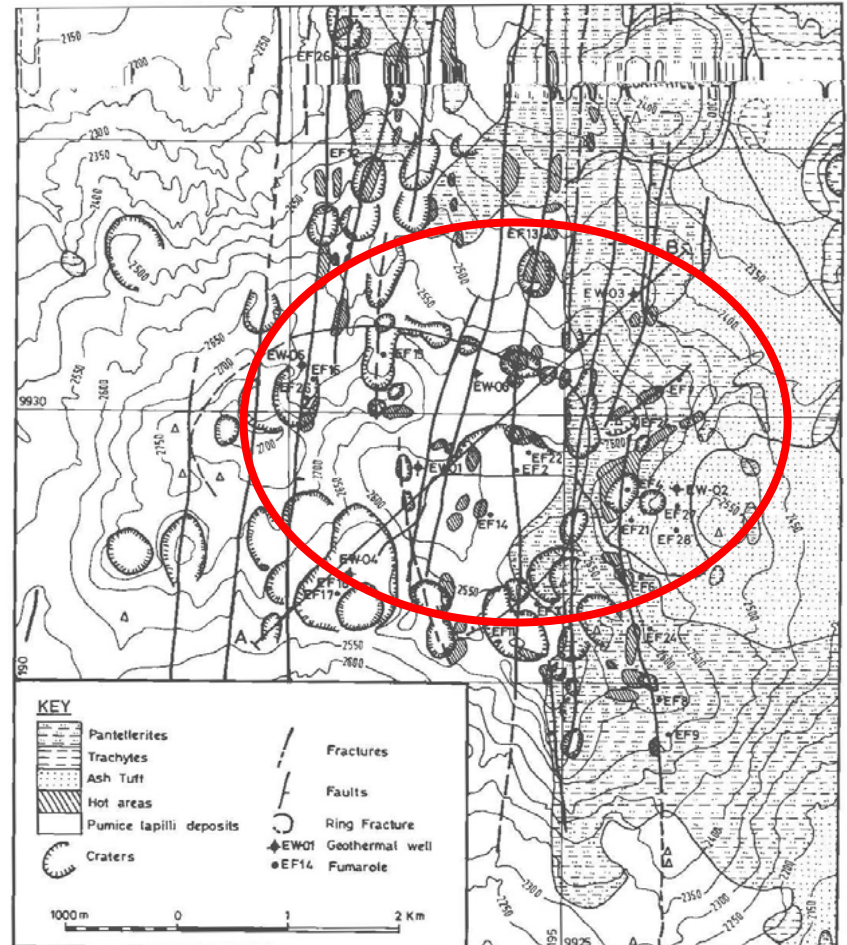
- Reservoir temp (>300°C) from geothermometry
- Estimated potential is more than 700 MWe based on >30km² potential area



MT at 2000 mbsl

Eburru Volcano

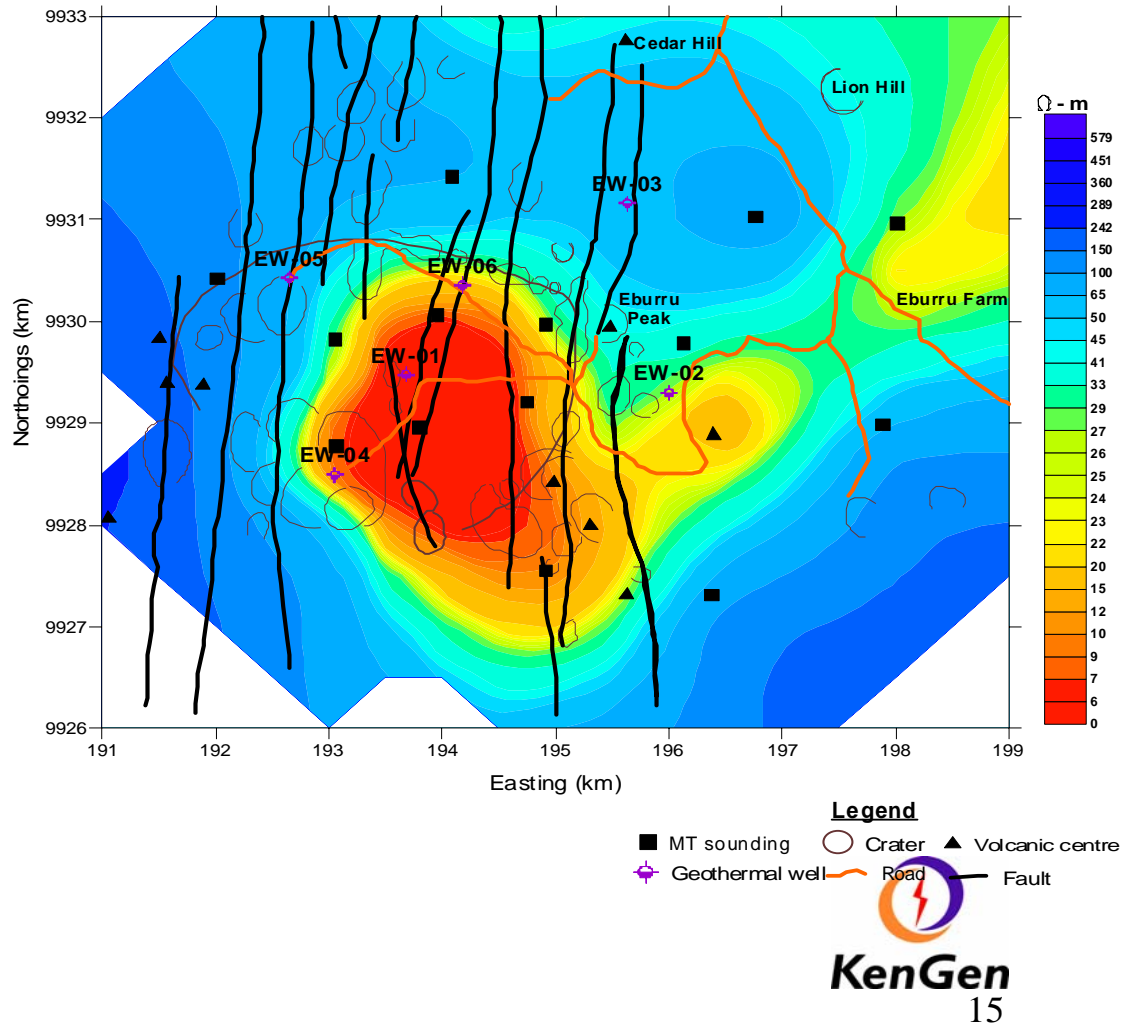
- Pleistocene caldera volcano
- 6 exploration wells drilled
- Maximum temperature is 285°C



Geological map of Eburru

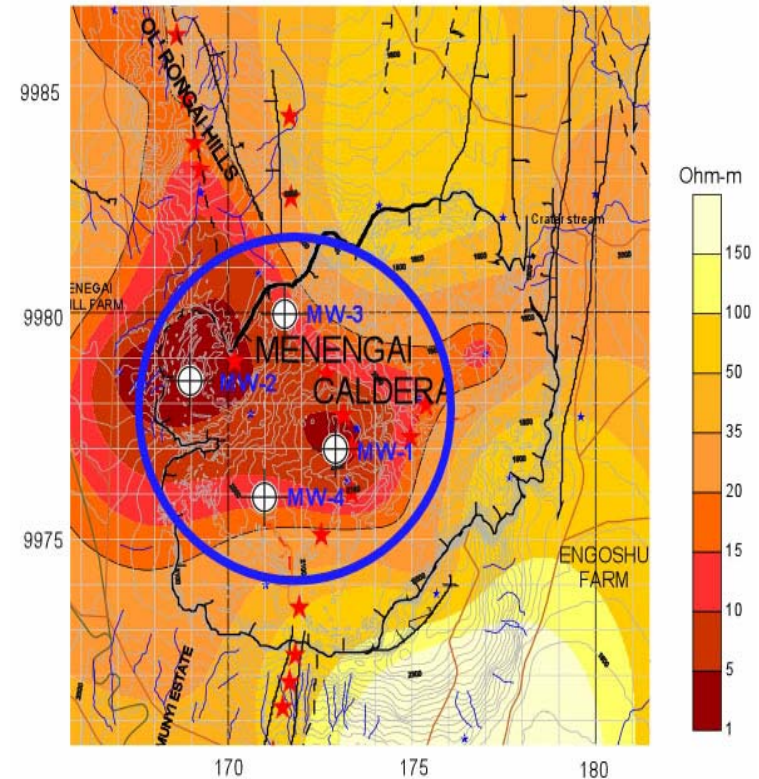
Geophysics-MT

- Heat source under the eastern volcano
- Resource Potential: >60 MW
- Pilot 2.5MW plant planned for 2007/8



Menengai Volcano

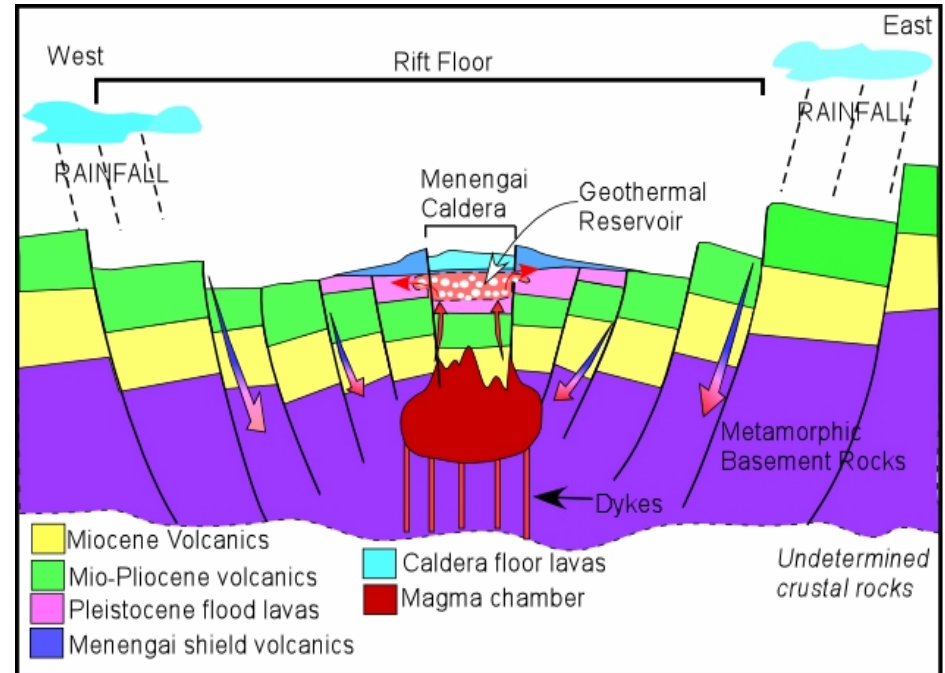
- A large caldera volcano on the rift floor ($>70\text{km}^2$)
- Low resistivity (<15 Ohm-m) at 2000 mbsl



MT Resistivity at 2000 mb s.l and proposed well site locations.

Menengai volcano

- Geothermometry indicate temp ($>300^{\circ}\text{C}$)
- Estimated power potential is over 1,000 MWe based on $>48\text{km}^2$ potential area



Conceptual model of Menengai prospect

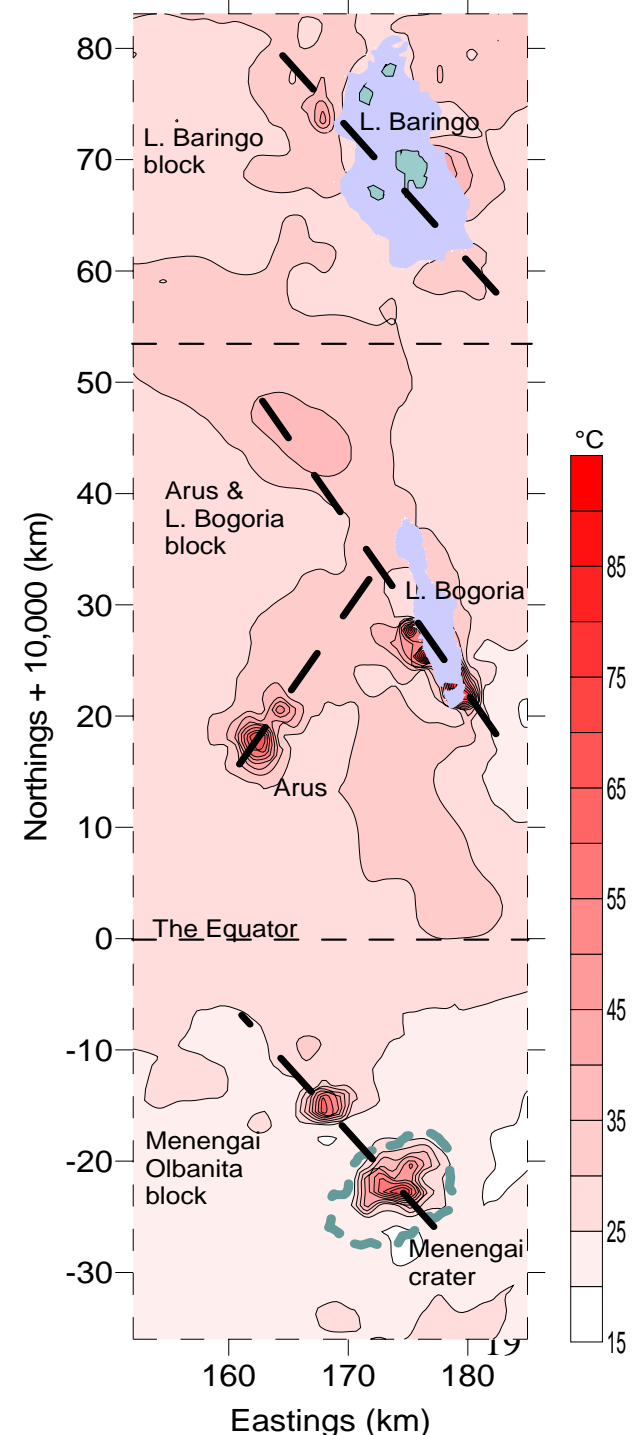
Arus & Lake Bogoria

- Plio-Pleistocene flood lava field
- Has hot springs, spouting springs, fumaroles hot grounds
- Manifestations are structurally controlled



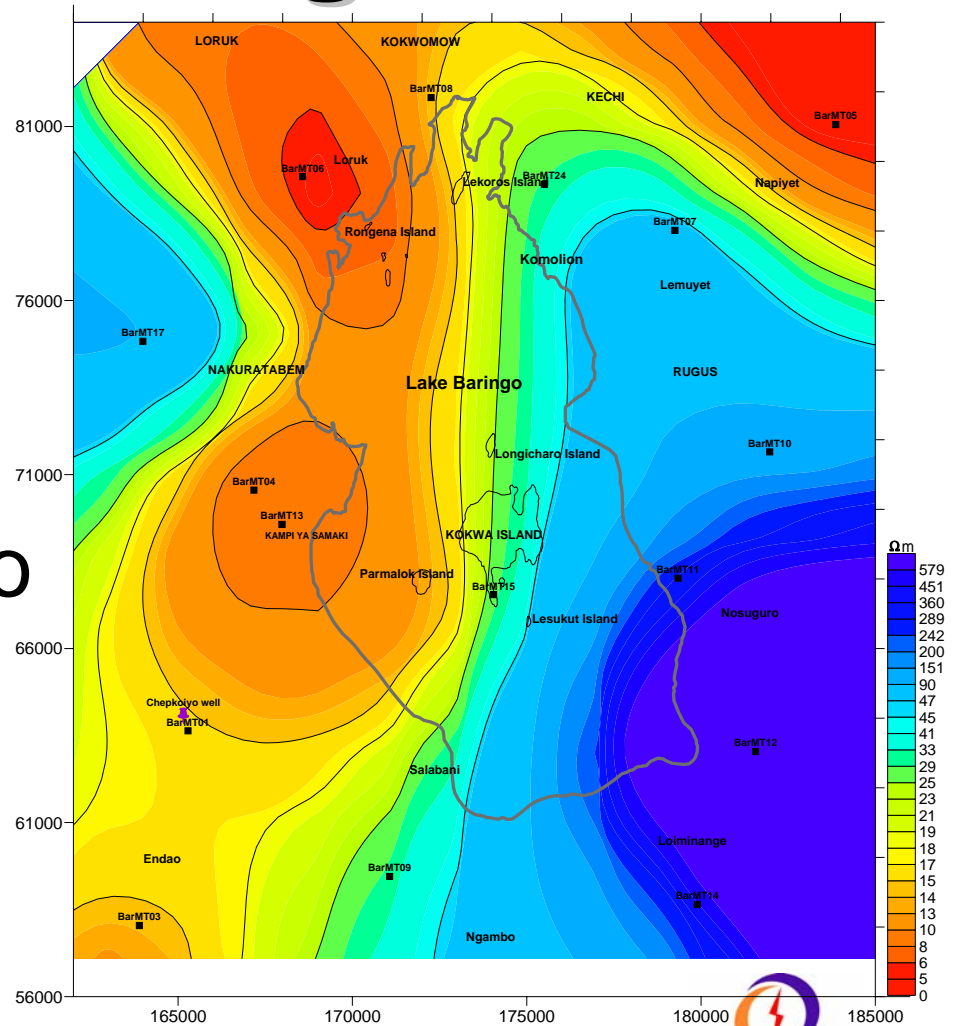
Bogoria/Arus area

- High heat flow covers large areas of Arus-Bogoria and Baringo areas



Lake Baringo

- No central volcano
- $>200^{\circ}\text{C}$ reservoir is present in the western region
- Heat source is due to dike swarms and plutonic intrusions



Korosi volcanic complex

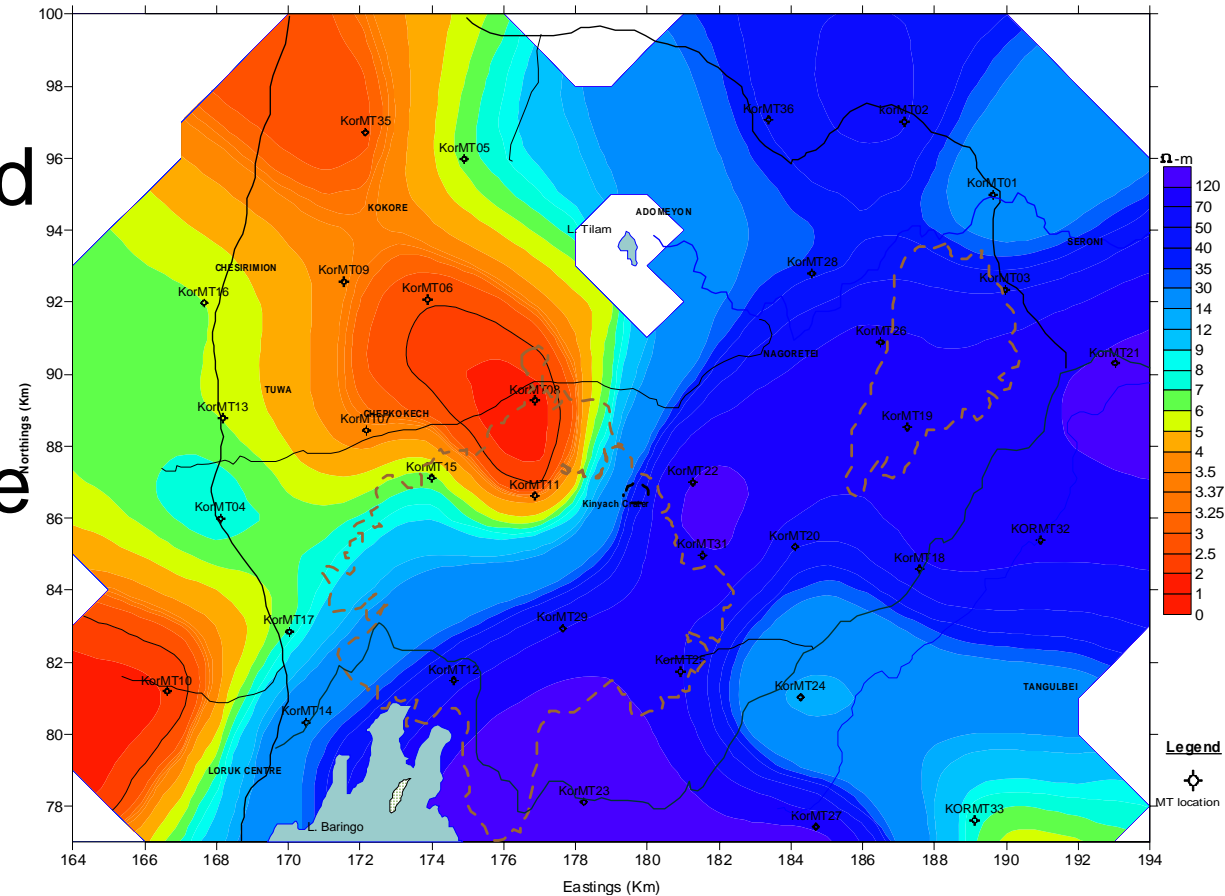
- Korosi is a Pleistocene volcanic complex
- Geothermometry indicates temperatures of more than 250°C



Korosi

Korosi volcano

- Main heat source is located northern part of the volcano
- Potential is more than 200 MW



Paka volcano

- Detailed surface investigations is currently being undertaken
- Last magmatic activity was <200 yrs
- High potential is expected due to high T fumaroles and other manifestations



Paka caldera

Silali

- Large caldera volcano
- Has the largest hot springs in the Kenya rift
 - 1,000l/s at 45-60°C discharge
- Planned for detailed investigations in 2007
- Large generation capacity is highly anticipated (>1,000MW?)



Emuruangogolak and Barrier volcanoes

- Emuruagogolak and Barrier are large caldera volcanoes north of Silali
- Youngest volcanic activity in the rift occurred at Barrier
- Large potential is expected of more than 1,200MW between the two



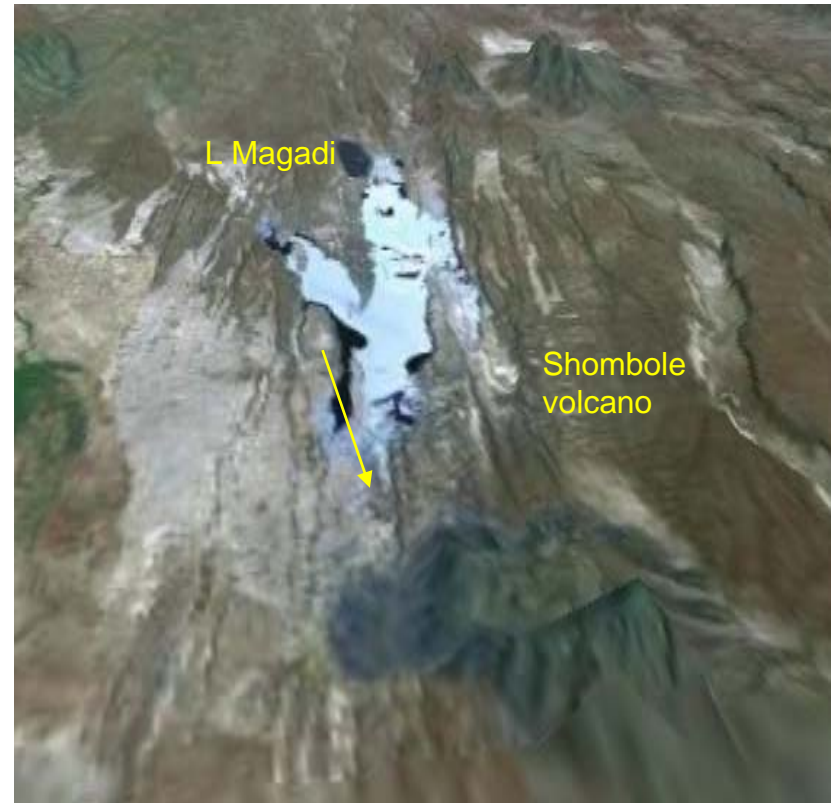
Emuruagogolak caldera



Barrier volcanic complex

Other prospects

- Lake Magadi in the south
- Elmenteita near Eburru
- Ol Banita north of Menengai
- Akira area south of Longonot



Conclusions

- Current estimates suggests that over 5,000MWe can be generated from the known resources in the rift
- Deep exploratory drilling is urgently required to prove the reservoirs

