“Geothermal as an Alternative Source of Energy for Tanzania” – a new GEOTHERM Project

P. Ndonde[1], C. Stadtler[2], N. Mwihava[3], K. Kessels[2], M. Kraml[2] & D. Delvaux[4]

Addis Ababa, ARGeoC1, 29.11.2006

[3]Ministry of Energy and Minerals (MEM), Dar es Salaam

(TANESCO (Tanzania Electric Supply Company Ltd.))

[1]Geological Survey of Tanzania (GST), Dodoma

[2]Bundesanstalt für Geowissenschaften und Rohstoffe (BGR), Hannover

[4]Royal Museum for Central Africa

Tanzania country background

Population: 34.6M (2002)

Pop. growth rate: 2.9%/year

Life expectancy: 50yrs,

GDP per capita $286

75% of population - rural

80% of rural population live under poverty line

Percapita energy consumption: 0.7 ToE (tonne of oil equivalent)

Rice market in Kyela

Electricity

Generating capacity (2005): **1018 MW**
72.3% owned & operated by TANESCO

Hydro	561 MW
Natural gas	182 MW
Diesel IPP	100 MW
Isolated 10 towns (decentralized)	55.5 MW
Other IPPs	41.5 MW
Imported (Zambia & Uganda)	13 MW

Consumption:	84 kWh/capita
Access to electricity:	**11.5** % of population
Rural population access to electricity:	2 %

Cement factory in Songwe basin

Challenges in electricity supply

- National power system is mostly relying on hydropower.
- A long period of drought between 2003 and 2006 and changing rainfall pattern are adversely affecting hydropower plants, they are no longer reliable as base-load.

Harbour of Dar es Salaam

Stages of geothermal development

Geothermal not included in "National Power Sector Master Plan" as there is still no planning data; inadequate exploration

- ✓ Project definition and reconnaissance study
- • Detailed exploration
- • Exploratory drilling & delineation
- • Resource data analysis & assessment of development potential
- • Field development
- • Steam production & resource management
- • Power plant construction

GEOTHERM Project in Tanzania

Objective: Tanzanian Institutions move further on evaluating the countries geothermal potential

Period: June 2006 – end of 2007

Mbeya with Ngozi volcano in background

Main project components:

- Training of Tanzanian experts in acquiring, analysing and interpreting exploration data
- Recommend potential locations for a geothermal exploration borehole in Songwe area on the basis of modern geothermal exploration methods
- Enabling MEM and GST to continue with geothermal exploration works
- Dissemination of information about possibilities of geothermal energy use in Tanzania among decision makers
- Search for funding for shallow drilling in Songwe

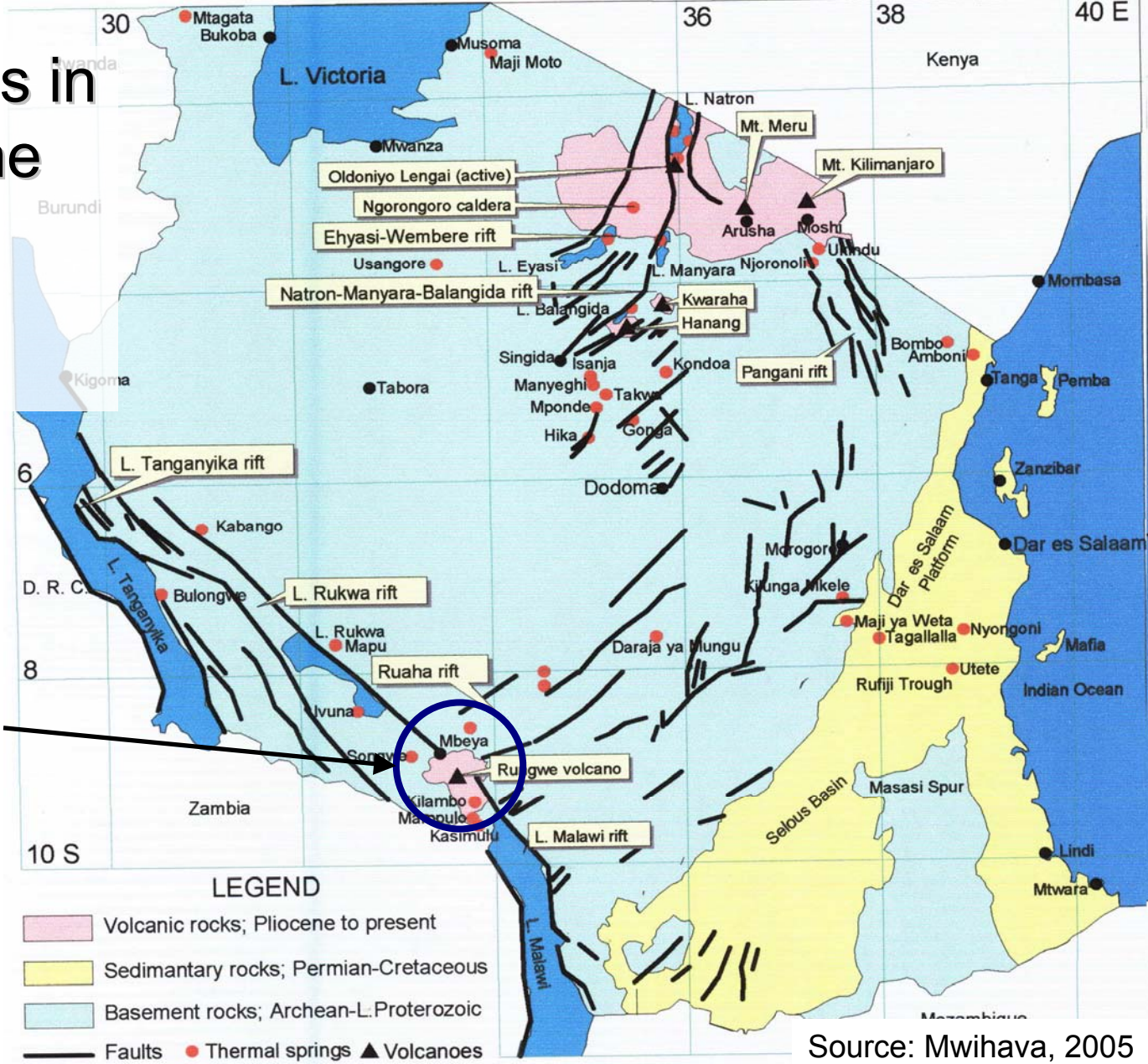
Travertine deposits in Songwe area

Main project activities in 2006:

- Training of Jacob Mayalla from MEM at UNU-GTP (geological exploration) in Iceland in 2006
- Appraisal mission, sampling of possible project sites and selection of one site as project area (June 2006)
- Test and upgrade of geophysical equipment of GST (August 2006)
- First short field survey (November 2006)

Fault with fluid flow in Songwe area

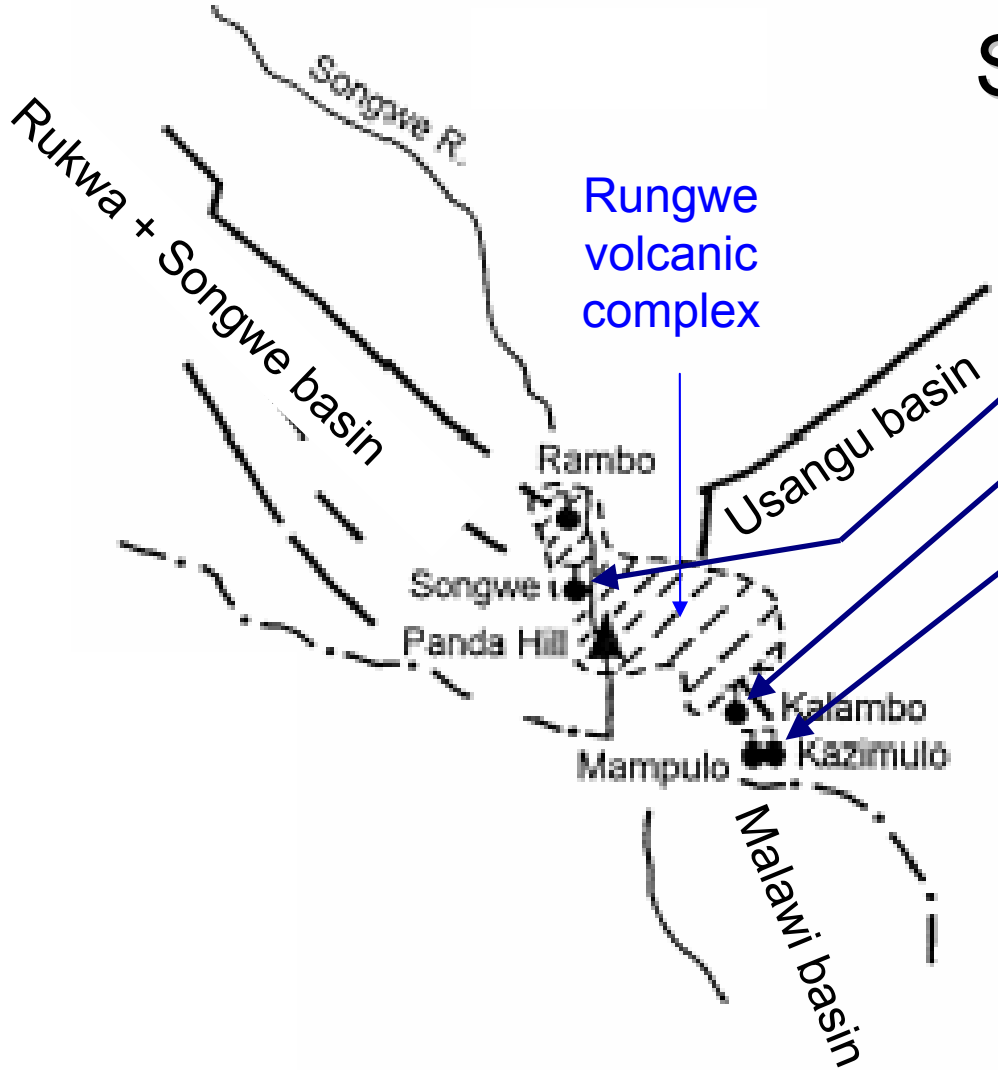
Geothermal sites in Tanzania and the selected GEOTHERM project region



Project region Mbeya (Rungwe volcanic complex)

Source: Mwihava, 2005

Selection of project site

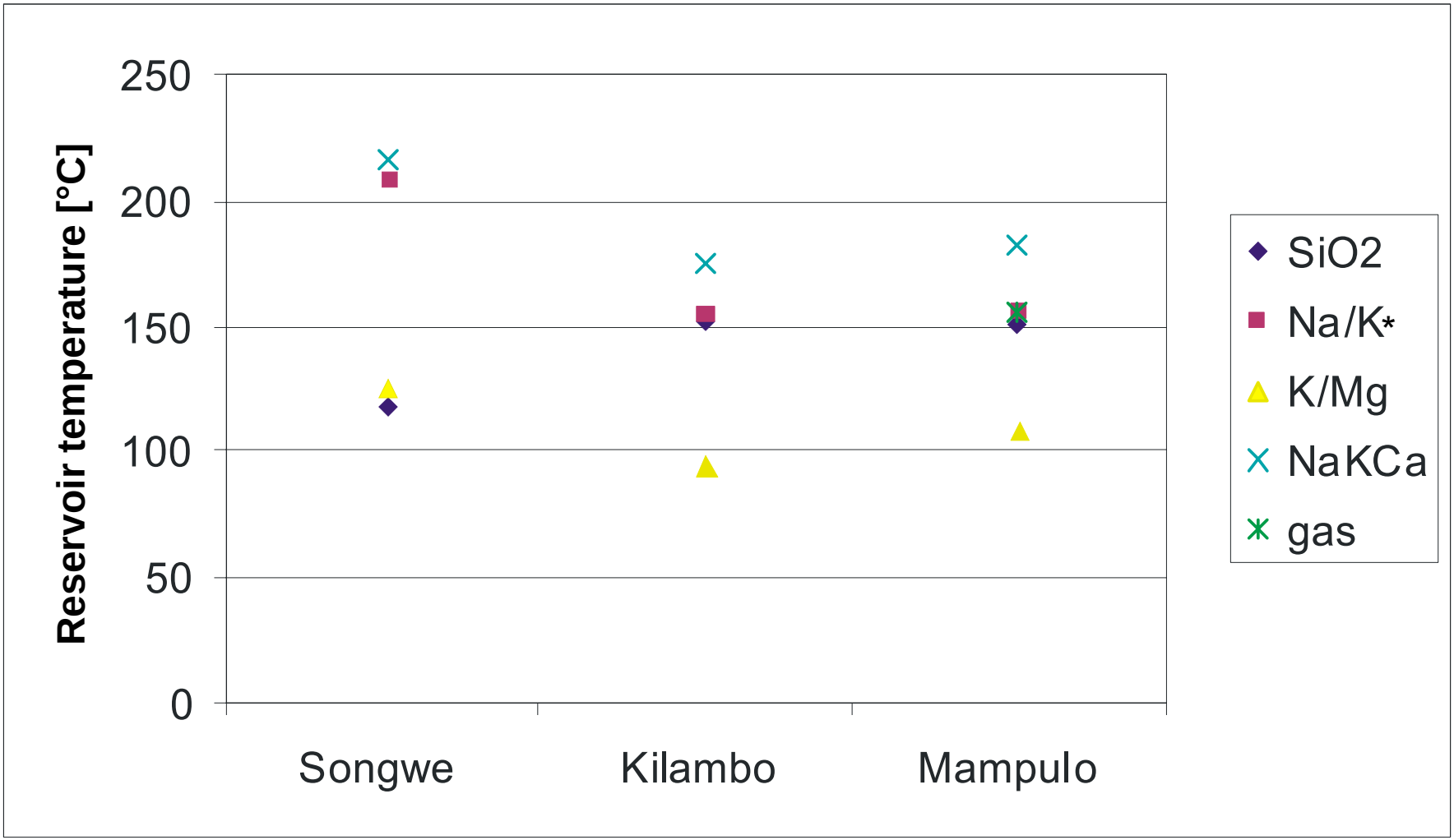


Appraised and sampled hot springs in June 2006:

- Songwe
- Kilambo/Makwehe
- Mampulo

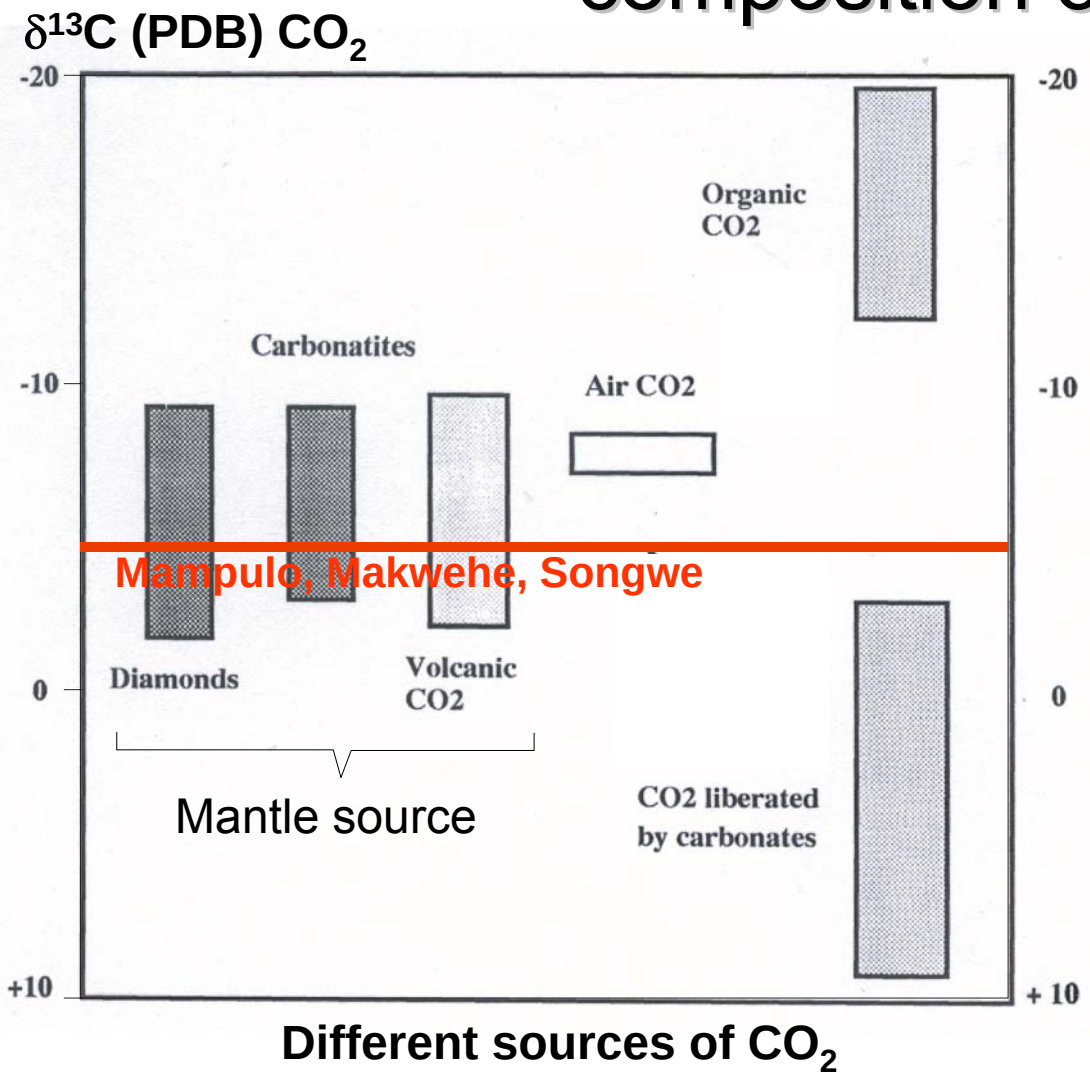
Project team in front of Lake Nyasa

Sampling results of June 2006: geothermometry



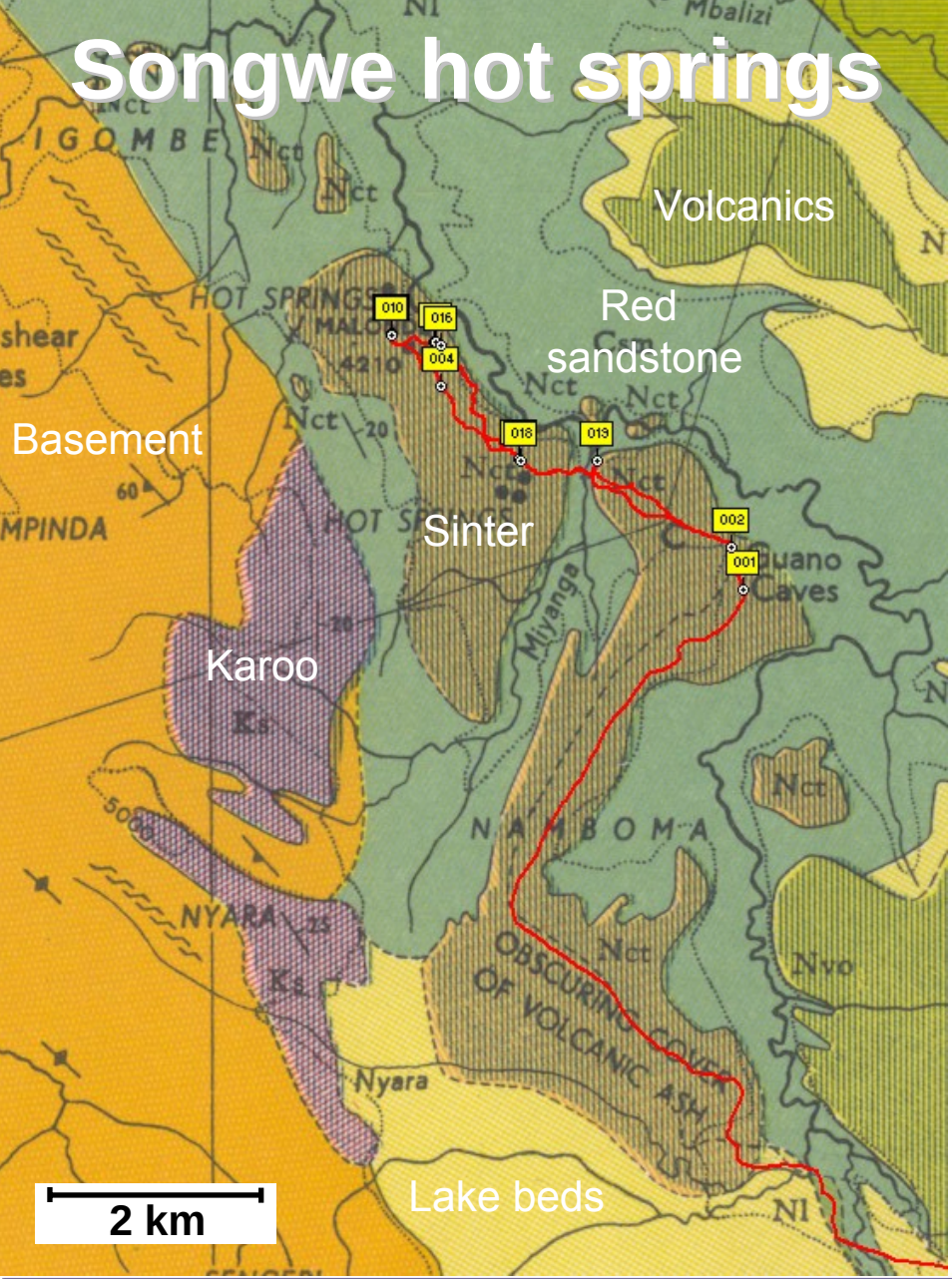
* improved Na/K (Can 2000)

Sampling results of June 2006: Carbon isotopic composition of CO_2



Different sources of CO_2

→ The geothermal systems of all sampled hot springs are driven by a magmatic heat source



Why Songwe?

logistical advantages

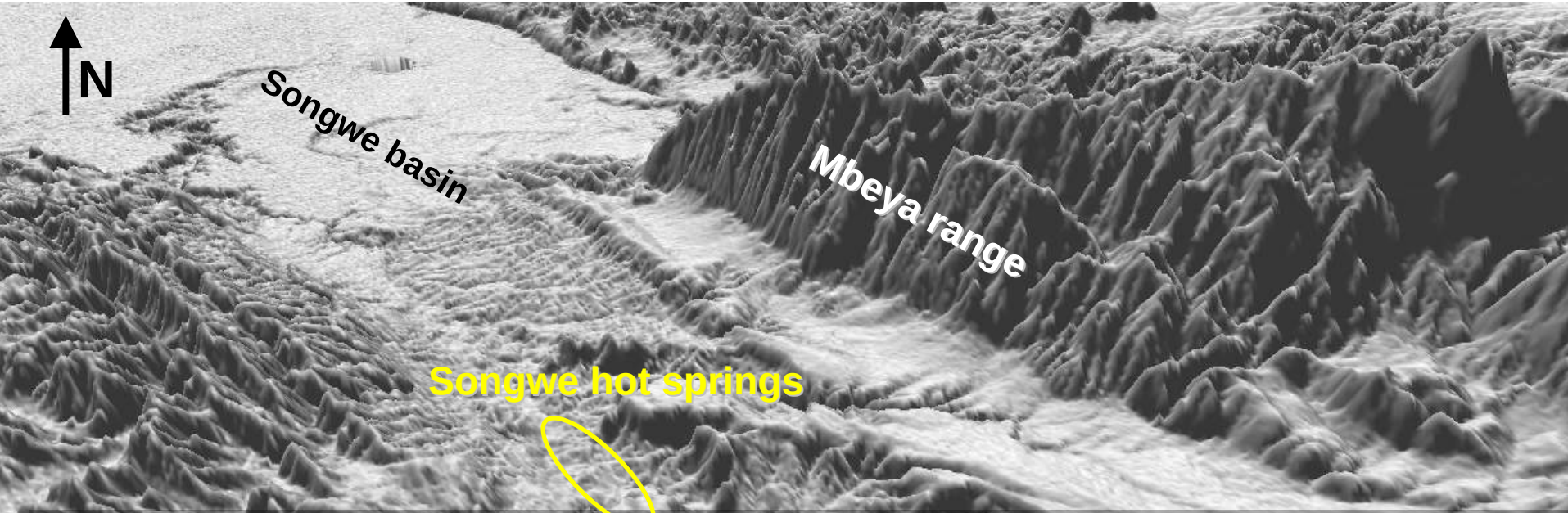
good general conditions for training

partly good terrain accessibility to apply a broad spectrum of geoscientific methods

comparably high natural release of thermal energy leads to the conclusion that a significant resource exists

recommended in the “Tanzanian Rural Electrification Study” (2005)

Songwe geothermal site



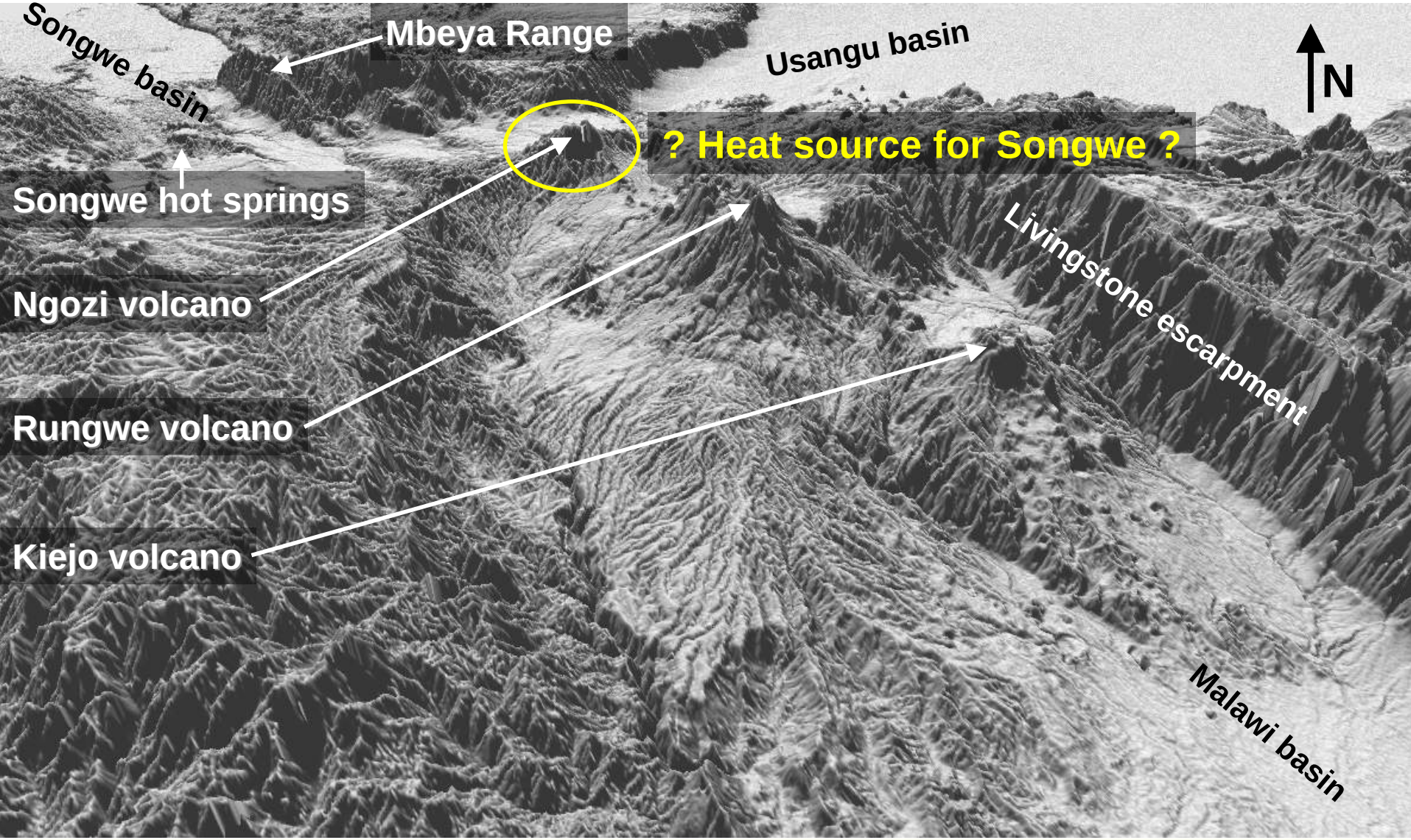
Songwe hot springs are the most impressive and active area in Tanzania

Tmax = 80°C; total discharge: 50-75 l/s; 150 million Tonnes of travertine deposit; natural heat loss: 10 MW_{th}

Indications that the Songwe hot springs mark the terminus of a concealed outflow of hot water, channeled by a confined system.

Where is the heat source and the related high-enthalpy geothermal system?

View over triple junction & Rungwe volcanic complex



First short field survey in November 2006

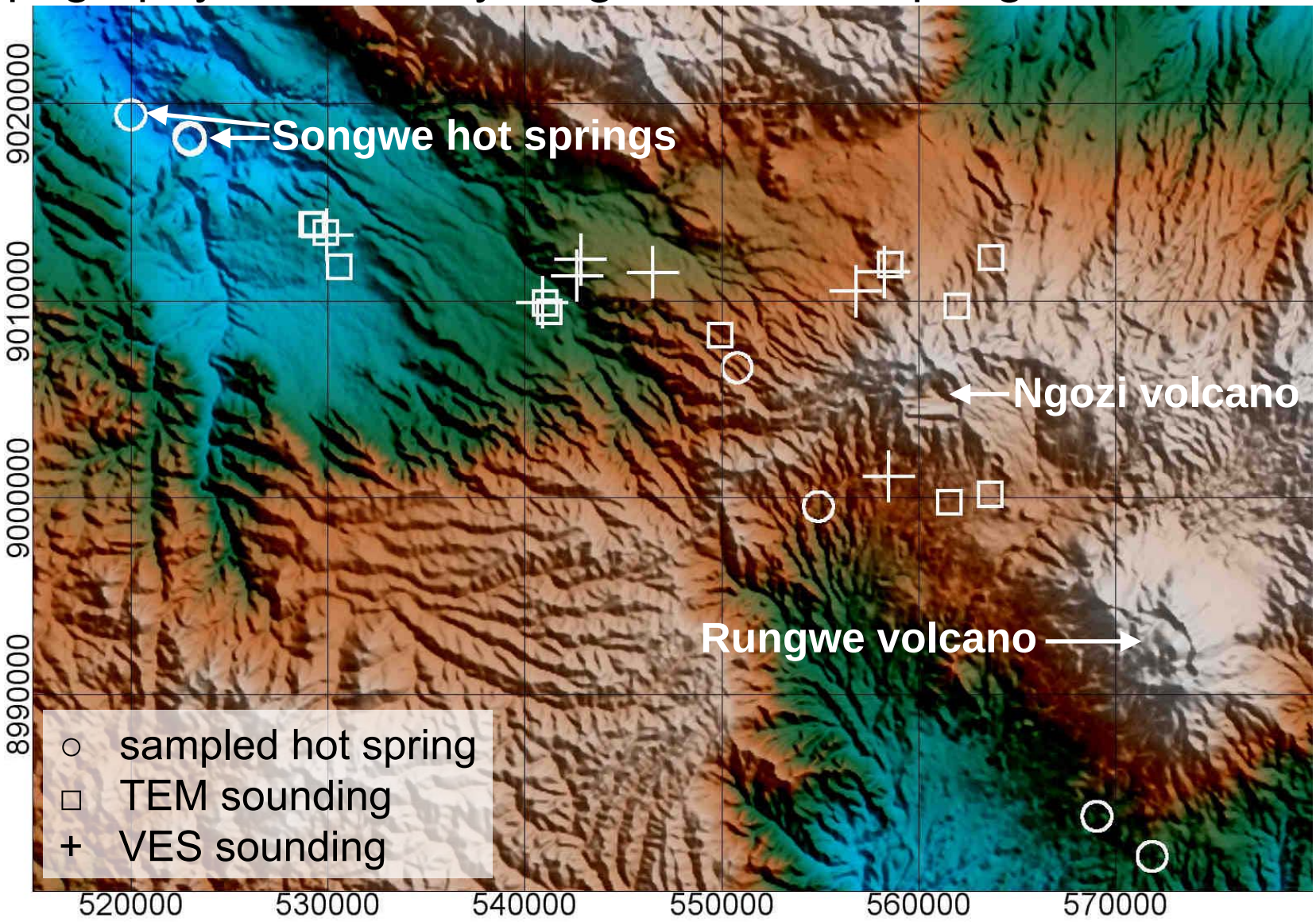
Duration: 31.10. – 14.11.2006

Applied methods:

- –Geological investigations
- –Sampling of rocks, fluids and gases
- –Transient electromagnetic soundings (TEM)
- –Schlumberger soundings (VES)

Lake Ngozi (caldera)

Topography of the Mbeya region with hot springs, TEM & VES



Outlook

Planned project activities:

- Training in data processing and interpretation of 1 or 2 scientists of GST at BGR in Hannover, Germany
- Planning of further field activities based on the results
  - Field survey in middle of 2007 (May?)
- Presentation and distribution of project results and possibilities of geothermal energy use (conference, workshop, exhibition, paper)
- Training additionally of one scientist of GST at UNU-GTP in Iceland in 2007 or 2008

School children in Mbeya

Skyline of Dar es Salaam


Thank you
Amesegnalehu
Asanteni sana