Geothermal potential in Eastern D.R. Congo

By

• Mambo Vikandy S.,
  Université Officielle de Ruwenzori, Butembo

• Kasereka Mahinda, Yalire Mapendano and Wafula Mifundu,
  Observatoire Volcanologique de Goma, Goma
Introduction

• D.R. Congo is known to be endowed with natural resources:
  • Minerals
  • Fresh water
  • Timber
• Electricity is therefore mainly obtained from Hydropower plants with enormous untapped resources.
• Current production: 1740 MW
• Only 10% of population benefit from electricity
Introduction (cont.)

• Due to the country’s large size, it is not evident that remote areas like the Kivu provinces will soon benefit from the main hydropower.

• There is need to develop alternative sources of power generation, esp. for remote country side.

• Geothermal energy can be a good alternative power source for Eastern Congo.
The eastern border of DRC lies in the western branch of the EARS, on more than 1500km.

It consists of seismic active zones with occurrence of earthquakes of high magnitude.

It also has active 2 volcanoes: Nyiragongo and Nyamulagira.

Several hot springs are found in the area.
Index map of the Western and Eastern Rifts in Africa
Major ‘Great Lakes’ of the East Africa rifts valleys
Major volcanoes and distribution of major 20th Century lava flows

ARGeo_C2, Ebb, DRC Presentation
The most recent eruption

- Mt. Nyiragongo eruption
  - Date: January 17, 2002
  - Death toll: 100 people (60 deaths by explosion of petrol stations)
  - Damages: 30% of Goma town destroyed or covered with thick lava
Volcanic Disaster in 2002

Lava flow pushes Lake Kivu 100m as the Lava enters 70m deep

A house covered with lava (6 personnes died inside)
Destruction of Goma town, mostly the business area
The recent major earthquakes

- Kalehe earthquake occurred on Oct 24, 2002 with 12 deaths
- Bukavu earthquake on February 3, 2008 with 44 deaths
Damages caused by earthquake in Kalehe (70 km south of Goma) on 24 Oct 2002

ARGeo_C2, Ebb, DRC Presentation
Earthquake parameters and disaster in Bukavu

- Time: Sunday Feb. 3, 2008 07:34 (UT)
- Location: 2.314°S, 28.896°E, Depth 10 km
  Birava (ca 20 km north of Bukavu)
- Magnitude (M): 6.0
  The largest earthquake in south Kivu since 1950
- Mechanism: Normal fault type
  Crustal block vertically faulting

- Death toll:
  RD Congo 7 (1)
  Rwanda 37 (19)
  Total 44 (20)
Damages of Steeple, on 3 Feb 2008

Shangi, Rwanda

Nkanka, Rwanda

Birava, RDC

ARGeo_C2, Ebb, DRC Presentation
The eastern border of D.R. Congo: the western branch of EARS. The most recently recorded seisms of magnitude >6 are also indicated, with the year of occurrence.

- Bukavu felt earthquake on Feb. 3, 2008
Some water sampling sites

- Hot spring
- Cold spring
- Rift limit
- Major regional faults
- Active Volcanic Centres
Sample and site information

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## Sample and site information (Cont.)

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3. Mahyuza
4. Kankule
5. Maziba
6. Mayi ya Moto
7. Kambo
8. Masambo
9. Mutsora
10. Mbau
11. Kikingi
Sampling and Analysis

• Date of sampling:
  – 1994: one sampling at Mayi ya Moto
  – 2002-08: other samples

• Chemical analysis:
  – 1994: in Japan (total analysis)
  – 2002-2003: Italy (total analysis)
  – 2008: Goma, OVG (only a few anions)
Results of Chemical Analyses

• All hot spring samples are characterized by high CO$_2$ content.

  Ratio $\text{Cl}/\text{HCO}_3$ is 0.007 – 0.3

  Ratio for Ugandan hot springs: 0.2 – 3.5

  (Bazaale-Dolo, 1971)

• It is well known that volcanic gases of Nyiragongo volcano contain almost 50% CO$_2$ unlike other high temperature gases where SO$_2$ is the most abundant after H$_2$O (Gerlach, 1983)
Results of Chemical Analyses (cont.)

- It is also known that Lake Kivu contains large amount of CO2 and CH4 (Tietze et al., 1980)
- Suggestion from this study: High CO2 content in hot springs of Eastern Congo is due to magmatic supply
Chemical Geothermometry

- Analytical data were used to estimate underground temperature
- Ca not used and no data for SiO2
- Na-K temperature were calculated using Truesdell, Fournier & Giggenbach formulas
- Calculations using Mg gave very low temperatures
Chemical Geothermometry (cont.)

- **North-Kivu**

- Mayi-ya-moto: 163-177 degree
- Tingi-Sake: *unrealiable*
- Kisuma/Masisi: *wide discrepancy of data*
Chemical Geothermometry (cont.)

- **South Kivu:**
  - Kankule: 337-369
  - Mahyuza: 345-374
  - Maziba: *unreliable*
Conclusion/Recommendations

• This is a preliminary study showing, on basis of geochemical data that geothermal potential exist in Eastern DRC.

• Further investigations are required including:
  – In-situ measurements of CO2, H2S, Rn, discharge rates, and heat flow.
  – Geological and geophysical surveys.
  – Isotope Hydrology.
  – Expand to wider area.
Acknowledgements

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Thank you
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