

## **Presentation of Geothermal Potential and the Status of Exploration in Democratic Republic of Congo**

Patrick M. Muanza

E-mail address: muanzapatrick@gmail.com

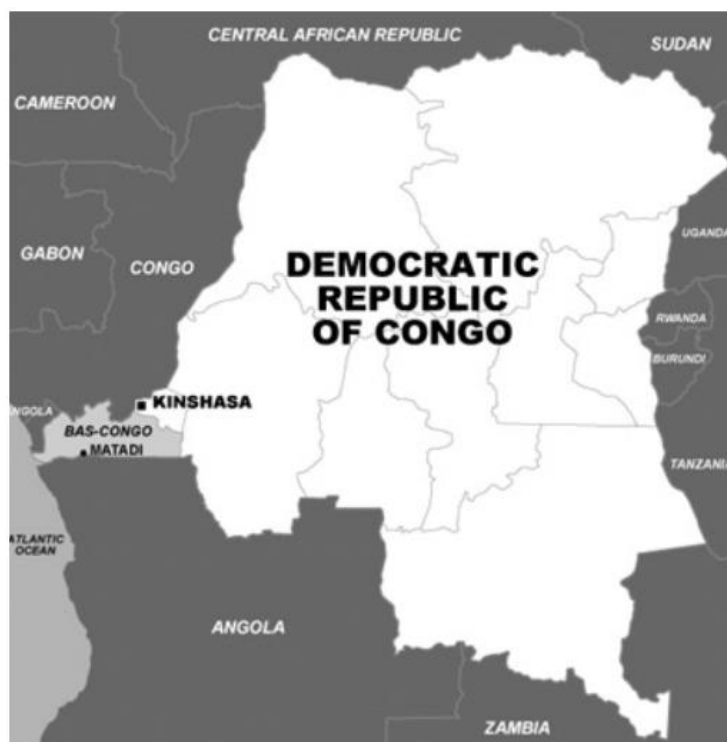
**Keywords:** Geothermal information

### **ABSTRACT**

The Democratic Republic of Congo is located in central Africa flanking the western branch of the East African Rift at its Eastern border. The major potential geothermal resources are related to the East African Rift System, particularly in the provinces of the Katanga, Maniema, the North and the South Kivu and the Oriental Province. These resources were not the subject of a survey retained in the past. Nevertheless, some among them have been identified and have been localized. A geothermal power station has been installed in the province of the Katanga in 1950's, but is not currently operating. Currently more projects are in progress with exploration campaigns in DRC.

### **1. INTRODUCTION**

The Democratic Republic of Congo (DRC) is a country in Central Africa. DRC is bounded by (clockwise from the southwest) Angola, the South Atlantic Ocean, the Republic of Congo, the Central African Republic, South Sudan, Uganda, Rwanda, Burundi, Tanzania across Lake Tanganyika, and Zambia.



**Figure 1. Map of Democratic Republic of Congo (The Civic United Front, web reference).**

The size of the DRC is 2,345,400 km<sup>2</sup> and has a population of 70 million people.

- Population : 70,000,000

- Hydrogeography : River Congo : 4.374 km along

Lakes : Mai-Ndombe, Tanganyika, Kivu, Eduard

In Democratic Republic of Congo, the thermal sources have been identified in its eastern part, especially in the provinces of the Katanga, Maniema, Two Kivu and Oriental Province. In the past, these sources were not subjects of any detailed survey. Nevertheless, some potential geothermal areas have been identified and have been localized. A geothermal power plant was put in operation in the province of Katanga.

## **2. THE OUTLINE OF THE THERMAL SOURCES IDENTIFIED IN DRC**

The thermal sources identified in DRC are described in this section.

### **2.1 Two Kivus**

#### Lulinga:

Temperature of 80 °C, sulfurous. Hot Springs Nyamukangaza: located about 7 km north of Uvira. Clear waters, temperature of about 68 °C, Hot Waters of Karaya: the temperature of water is about 50 °C.

#### Masiba Tshavunda:

Temperature of water is 40 °C.

#### Masiba Ya Kalungwe:

Temperature varies between 82 °C and 97 °C.

Sources in the graben region of Central Africa.

Kaswa, Kibero and Bitagoha :

Temperature range of 50 °C to 85 °C.

### **2.2 Orientale Province**

#### Sources in the valley of the Lualaba:

The average temperature of these resources is 60 °C. The thermal sources include: sulfurous thermal source of Pene Sipo, the thermal salt marshes of Lufubu, and the thermal source of Kibimbi (temperature is about 70 °C).

#### Sources in the basin of Luika:

Muese and Kilenga : Clear water, temperature is about 35 °C.

#### Sources in the basin of the Luama:

Kitete, Kalingusi, Mwasiwagongo, Michelonde Maloshi and Nionga : clear water, temperature is about 45 °C - 84 °C.

#### Sources in the basin of Elila:

Pene - Mwanga, Luganza, Lukuka, Musonguela, Itofia, Kitutu, Michelonde Tente-Tenge, Kegele, and Kakungu : Temperature is about 55 °C - 95 °C.

#### Sources in the basin of Ulindi:

Nalungwa and Midubo : the temperature is about 40 °C - 50 °C.

#### Sources in the basin of Lowa:

Njandu, Luwangi, Luvungi, and Mutambala: the temperature is about 56 °C - 68 °C.

### **2.3 Maniema**

Kalo-Kola, Lukula, and Kasuku – Lambo: temperature not known.

### **2.4 Katanga**

#### Lufira:

present the following features:

#### Tanganyika:

Hot sources (40 °C to 50 °C), slightly carbonated.

#### Upemba:

Very hot sources (70 °C to 100 °C).

Other geothermal resources of the Katanga:

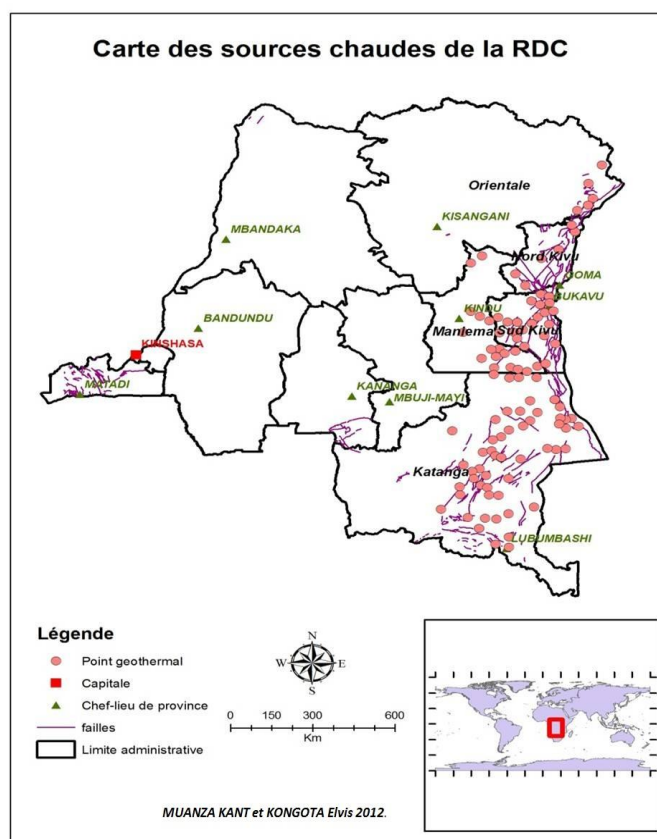
Tanta - Mukola, Kashiba, Kafungwe, Kasongo, Katapena, Pun'u, Kaniamba, Konkula, Kafumwe, Kiabukwa, Kafinga, Kayumba, Kiarue, Kalumumbale, Kaï, Mbalaï, Kibimbi, Lukulu Sanga, Ganza, Rutuku, Kayunga, Kahonto, Pakundi, Luiboso, Mulala, Kabila, Kasanza, Kisande - Kapindo, Samba, Lufuko, Kala, Pye, Kakonbwe, Biluwe, Lupashia, Kaswela, Ndombe - Mudilo, Kanunka, Kipia, Kiumu, May - Moto, Tumba, Mulezi, Niamalonga, Kiziba, and Kilimulilu.



**Figure 2. Picture of Kiabukwa power plant in Katanga (1952).**

The Kiabukwa Geothermal power station in Katanga has existed since 1952, but is no longer functional. This power station had been presented as follows:

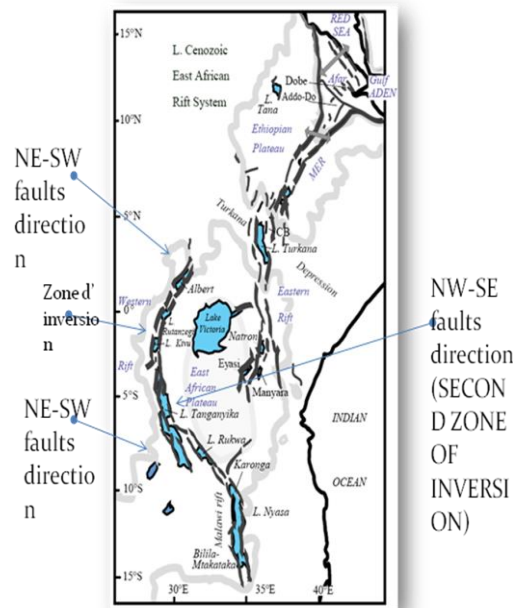
It has been located in the vicinity of 10 km of lake Bukena. It springs to the rating of 618 m. In the valley of the small Mabila River, the flow rate is 40 l/s and very regular. The temperature to the griffin of the source is 91°C. At the time of the establishment of the project, the production of electricity was 550,000 kWh (0.5 MWh) per year against the expected 1,400,000 kWh.



**Figure 3. Illustration of the locations of geothermal resources in D.R.Congo.**

### 3. INTERPRETATIVE COMMENTARY ON THE RELATION OF THERMAL SOURCES AND TECTONICS

The hot springs are related to the tectonic fractures. Manifestations appear only at hot springs in the folded regions, where the old fractures were subjected to reactivation. The reactivation led to the creation of new fractures. In the Orientale and Katanga provinces, hydrothermal vents are related to fault zones that form the grabens and their extensions. Some of them seem to indicate the location of basement faults, for which activity may be more recent.



**Figure 4. East African Rift presentation and accompanying faults.**

Kivu is located near the elbow of the system of fractures of the graben, and where volcanic activity and numerous thermal sources appear. In the southwesterly extension of the graben system, fault orientation follows the direction Albert Lake - Kivu Lake. Thermal sources appear near the basins of the high Ulindi, the high Elila and the low Luama. In Katanga, according to the documentation the thermal sources group themselves according to the tracing of the big graben centers African, along the oriental fractures of the graben of Upemba and according to the field of fractures, again enough definite pain, that connects this last ditch to the graben of the region of the big lakes. Hot sources that are distributed in the whole oriental province and south zone of the Congolese basin have high temperatures and the very various chemical compositions. The hot sources of DRC are distinctly in relation with these types of faults:

1. The faults directed according to North - West.
2. The faults directed according to North - East.
3. Intersection of these two previous directions.
4. Hot sources without visible relation with the known falls.

The sources of Type 3 are concentrated around Bukavu and seem to be characterized by waters to very elevated temperature. In this zone one also notes that the tectonic intensity is the biggest because of the intersection of two directions of faults.

### 4. CONCLUSION AND PERSPECTIVES

In spite of the observations, the Democratic Republic of Congo has a huge potential geothermal, but so far has not performed a comprehensive study. According to the documentation, the Oriental and Katanga provinces contain the majority of sources that have already been identified. The government is setting up a special committee for the development of geothermal energy in the DRC. Some projects are underway such as "Regional Project for Geothermal Exploration in Rwanda, Burundi and DRC," which are three member countries of Communauté Economique des Pays des Grands Lacs (CEPGL).

### REFERENCES

- Boutakoff N. (1939): Le coude du système des fractures du graben central africain au Lac Kivu et sa ramification dans la cuvette congolaise. Bull. de la Sc. Belge de Géol. Bxl. Rue de Louvain, 112.
- Cahen L. (1954): Géologie du Congo Belge. Liège, imprimerie H. Vaillant – Carmanne, S.A. 4, place Saint Michel, 4.
- Kant Kabalu (1978): Etude pétrographique des différents faciès de la carbonatite de Lueshe. Travail de deuxième cycle (Mémoire/Unilu).
- Lepersonne (1974): Notice explicative de la carte géologique du Zaïre au 1/2 000000.

Maurice Robert (1956): Géologie et Géographie du Katanga. Bruxelles, 1956.

Roumache A.: «Uvira» dossier collaborateur S.A 35.24 : Centre des Recherches Géologiques et Minières.

Salée A, Boutakoff N., J. de la Vallée Poussin (1939): Constitution Géologique de la région du Kivu. Editeur 10-12, Rue de la monnaie, 10-12.