Available online at www.sciencedirect.com

ScienceDirect

Energy Procedia 125 (2017) 291–299

Energy Procedia

www.elsevier.com/locate/procedia

European Geosciences Union General Assembly 2017, EGU Division Energy, Resources & Environment, ERE

Thorium Resources and their Energy Potential in Georgian Republic, the Caucasus

Avtandil Okrostsvaridze[a]*, Salome Gogoladze [a]

[a]*Institute of Earth Sciences, Ilia State University, 3/5 K. Cholokashvili ave., Tbilisi, 0162, Georgia*

Abstract

Because of its unique properties thorium is considered as the main energy resource in the 3rd millennium. In Georgia are detected four Thorium ore occurrences: 1 - In the Sothern slope of the Greater Caucasus (Th con. 51 g/t - 3882 g/t), 2 - In the Dzirula massif (Th con. 117 g/t - 266 g/t), 3 - In Vakijvari ore field (Th con.185 g/t - 1600 g/t), 4 - In the Black Sea magnetite sands (Th con. 200 g/t - 450 g/t). Based on these data Georgian thorium ore occurrences should be treated as potential resources.

Peer-review under responsibility of the scientific committee of the European Geosciences Union (EGU) General Assembly 2017 – Division Energy, Resources and the Environment (ERE).

Keywords: The Caucasus, Georgia, thorium ore, the magnetite Sand;

1. Introduction

According to the UNESCO data the world's population exceeded 7 billion, and the organization predicts that this number will double at the end of the century. At the same time, an intense process of urbanization and technological progress is on going, which leads to an increase in total energy demand and consumption. As is well known energy resources, currently consumed by modern civilization, are represented by hydrocarbons - 78-80 %, however these reserves are exhausting. At the same time, the gas CO_2, separated because of hydrocarbons combustion, intensely pollutes the atmosphere and have significantly negative impact on the environment, including human life.

* Corresponding author. Tel.: +995557108810.
E-mail address: avtandil.okrostsvaridze@iliauni.edu.ge

1876-6102
Peer-review under responsibility of the scientific committee of the European Geosciences Union (EGU) General Assembly 2017 – Division Energy, Resources and the Environment (ERE).
10.1016/j.egypro.2017.08.185

In light of these challenges, search of new energy resources is vital importance problem for the modern civilization. Based on the analysis of existing energy reserves and potential, the renewable and nuclear energy should be considered as the main energy resources for the future of our civilization,. Taking into account the total potential of renewable energy, according to all estimates, only 23-25% of it can meet the needs of humanity, then it turns out that for our future energy supply, nuclear energy has no alternative. Unfortunately, all over the world all nuclear power plants work on uranium, which potentially poses a big threat because of its properties. However, thorium is that like uranium and it can be used as fuel in nuclear reactors. However, thorium has a number of advantages compared to the Uranium. It is concentrated in the earth crust 4-5 times more than uranium; extraction and enrichment of thorium is much cheaper than uranium's; it is less radioactive; complete destruction of its waste products is possible; thorium yields much more energy than uranium. Because of unique properties and currently existed difficult energetic situation, thorium is considered as the main energy resource in the 3rd millennium of the human civilization [1]. Moreover, some scientists, due to the safety of this element, consider it as future green energy [2].

Unfortunately, government of Georgia does not pay any attention to thorium energy potential, also, systematic investigation has never been carried out in the country, however its geological construction creates precondition of possible existence of thorium considerable deposits in the earth crust.

Available information on thorium occurrences of Georgia is collected and analyzed in the presented paper, which, in our opinion should be of great interest for researchers of this important energy element deposits.

2. Geological Framework of Georgia

The Caucasus represents a collisional orogen that formed along the Eurasian North continental margin and extends over 1200 km from Caspian to Black Sea. Currently it represents the Tethyan segment connecting the Mediterranean and Iran-Himalayan orogenic belts, between the Gondvana-derived Arabian plate and East European platform. Three major geological units are distinguished in its construction: the Greater and Lesser Caucasian mobile belts and the Transcaucasus microplate [3]. According of the terrane analyses the Greater Caucasian, Black Sea-Central Transcaucasian, Baiburt-Sevanian (Lesser Caucasian) and Iran-Afghanian terranes are identified in the Caucasian segment (Fig. 1). They are separated from each other by ophiolitic suture zones or powerful tectonic faults which in geological past represented island arcs or microcontinents [4]. The territory of Georgia covers southern part of the Greater Caucasus, the Transcaucasus and northern part of Lesser Caucasus that is why is characterized by a complex geological structure.

The structure and geological history of the Caucasus are largely determined by its position between the still-converging Eurasian and Africa-Arabian lithospheric plates, within a wide zone of continental collision. During the Late Proterozoic -Early Cenozoic, the region belonged to the Tethys Ocean and its Eurasian and Africa-Arabian margins where there existed a system of island arcs, intra-arc rifts and back-arc basins characteristic for the pre-collisional stage of its evolution of the region [5].

Modern research shows that in formation of the Caucasus orogen pre-Mesozoic crust significant role was played by Gondvana-derived micro-plates, which formed after the destruction of the Gondvana southern edge in the Ordovician period. Large part of them started moving towards the North and accreted at the S-E edge of the Euro-Asia continent. Building the skeleton, this underwent significant thermal recycling and transformation in composition and gradually formed the modern crust of the Caucasus orogen. Despite the multiple tectonic, metamorphic and thermal processing (Variscan, Cimmerian and Alpine), they have still preserved Gondvanian relicts, which are considered as pre-Variscan "crystalline basement" [3]. The complex geological and isotopic (Sm-Nd, U-Pb, Rb-Sr and ^{40}Ar-^{39}Ar systems) data of these relicts, enabled us to restore the history of their evolution. The Caucasus Carboniferous granitiods (330 - 305 Ma; U-Pb, Rb-Sr and ^{40}Ar-^{39}Ar age) contain numerous inherited zircons of a major Hf isotopic age distribution at ca. 700-500 Ma and strongly various Hf isotope composition, indicating an affiliation to magmatic activities that produced the juvenile Arabian-Nubian Shield crust and reworked Neoproterozoic materials in the Northern Gondvana [6]. According to our data, Gondvana-Derived relicts were