E-ISSN : 2963-4946
Vol. 2 No. July 10, 2024
Asian Journal of Social and Humanities
https://ajosh.org/

Study of Element Abundance in Volcanic Rocks in the Beruang Kanan Region, Gunung Mas Regency, Central Kalimantan

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KEYWORDS
ain elements; volcanic rocks; affinity; magmatic

ABSTRACT
The purpose of this study is to find out study of Element Abundance in Volcanic Rocks in the Beruang Kanan Region, Gunung Mas Regency, Central Kalimantan. Soil elements, based on their abundance in the earth's crust and petrogenetic analysis aim to divide soil elements into several groups, namely major elements, trace elements and rare earth elements (REE). The research location is located in the Beruang Kanan area, Tumbang Miri District, Gunung Mas Regency, Central Kalimantan Province. The major elements and trace elements of the host rock were obtained from X-ray fluorescence (XRF) analysis and Plasma-Coupled Mass Spectrometry (ICP-MS) methods. Volcanic rocks from the Kanan Bear prospect The volcanic magmatic affinity in the study area is calc-alkaline this chemical characteristic is clearly reflected by the type of volcanic rock which is determined based on its chemical classification, which is generally igneous rock of the calc-alkaline magma series type so it is interpreted to originate from a convergent tectonic environment continental edge.

Introduction

Soil elements, based on their abundance in the earth's crust and petrogenetic analysis aim to divide soil elements into several groups, namely major elements, trace elements and rare earth elements (REE). The main element is the dominant element in more than 99% by weight of the igneous rock components, as a compound that forms igneous minerals such as feldspar, quartz, mica, olivine, pyroxene and amphibole (Mielke, 1979) (Wilson, 1989). There are 11 main elements O, Si, Ti, Na, K, Ca, Mg, Al, Fe, P and Mn. Major elements generally account for more than 1wt% in the crust. Some elements are often present at less than 1% but more than 0.1% by weight and are often referred to as light elements such as Ti, Mn, O and C (Hackmann, 2014). Elements other than the major elements and minor elements are known as elements and rare earth elements such as Rb, Sr, Y, Nb, Zr, Cr, Ni, Cu, Zn, Ga, Ba, Pb, Th, U La, Ce, Nd, Sm

and other specific trace elements including Sc, Co, Cs , Hf, Ta are important as petrogenetic parameters (Mielke, 1979). Rare Earth Elements are a group of elements that have relatively the same properties and generally form in the same geological environment (Hall, 2014). The research location is located in the Beruang Kanan area, Tumbang Miri District, Gunung Mas Regency, Central Kalimantan Province. Based on this, it is known that this research location is part of the Wavy Hills Geomorphological Unit in the central part of Kalimantan Island. The Schwaner Mountains stretch in the center (KSK, 2004). The research area has a height ranging from ± 50 meters to ± 400 meters. Generally, the landscape of the study area is steep and very rugged. The topography is dominated by hills. Bukit Beruang Kanan (439 m) is the highest part in this area (BALLHAUS & SYLVESTER, 2000).

In addition to major elements and light elements, there are also trace elements and rare earth elements which, although present in small quantities, have an important role in petrogenesis (Corbett, 2018). Elements such as rubidium, strontium, yttrium, niobium, zirconium, chromium, nickel, copper, zinc, gallium, barium, lead, thorium, and uranium, as well as rare earth elements such as lanthanum, cerium, neodymium, and samarium, are frequently used as an indicator in petrogenetic studies to understand geological history and rock formation processes (Chryssoulis, 2021). This research will be carried out in the Beruang Kanan area, Tumbang Miri District, Gunung Mas Regency, Central Kalimantan, which is part of the Geomorphological Unit of the Berombak Hills and Schwaner Mountains. This area is known to have steep and hilly topography, with a height of between 50 and 400 meters, and Bukit Beruang Kanan is the highest point (Corbett, 2019).

Research on soil elements and minerals in the Central Kalimantan region, especially in the Gunung Mas area, has been carried out by various researchers. For example, KSK research (2004) states that the geological formations in this region consist of igneous and metamorphic rocks which are rich in main minerals such as feldspar and quartz. The research also identified concentrations of rare earth elements (REE) in several locations, which indicate economic value. Additionally, research by (Einaudi et al., 2015) highlights the importance of rare earth elements in modern technological applications, such as in the manufacture of permanent magnets and electronic components.

This research adds novelty value by focusing on a more in-depth and specific petrogenetic analysis of the Beruang Kanan area. Another novelty of this research is the use of modern analytical technology to map the distribution of rare earth elements in more detail. Thus, this research not only strengthens previous findings but also provides new insights into the mineral potential of this region. Techniques used include X-ray fluorescence (XRF) and inductively coupled plasma mass spectrometry (ICP-MS), which enable high-precision identification of elements.

Research Methods

Samples will be collected in the field to analyze geochemical studies as XRF and ICP-MS to identify the geochemical conditions of ore deposition, petrogenesis and ore paragenesis. X-Ray Fluorescence Spectroscopy (XRF) X-ray fluorescence analysis is a widely used method for measuring whole rock geochemical data for its main oxide elements (Idrus, 2015). How it works is based on the principles of scattered wave spectroscopy. The chemical composition of the source rock and altered rock/minerals will be analyzed by XRF. Analysis of major and minor elements in the Earth's elemental content by XRF is made possible by the behavior of atoms when interacting with X-

radiation rays. This technique is suitable for the analysis of rocks, mineral concentrates and products. Analysis was carried out on 20 examples of the 3 existing types of alteration. This analysis was carried out at ALS Geochemical, Canada. Inductively coupled Plasma Mass Spectrometry (ICP-MS) To trace and some rare earth elements will also be analyzed with Inductively coupled Plasma Mass Spectrometry (ICP-MS). This is a relatively new technique with enormous potential in geochemistry. This method is capable of measuring some elements in the periodic table with low detection limits and good precision. ICP-MS can be utilized as a quantitative tool to determine the concentration of a particular analyte, or as a qualitative tool to determine the specialization of metals in a sample. Analysis was carried out on 20 examples of the 3 existing types of alteration (Garwin et al., 2015). This analysis was carried out at ALS Geochemical, Canada. Rock units in the research area are differentiated based on the type of lithology, rock uniformity, rock distribution and rock geometry found in one area as well as the stratigraphic position of the units below and above it. Rock units in the study area have generally experienced a strong alteration process as a whole so that the primary mineral composition of the rock has been replaced by secondary minerals (alteration minerals). Determining the rock sequence uses the law of cross cutting, using regional geological map sources and previous research data. In general, the stratigraphy of the research area is divided into 3 rock units that can be seen on the geological map, in order from old to young, namely the lithology of the Sandstone Unit, the Dacitic Tuff Unit, the Andesite Unit and the Quartz Sand Deposit Unit (Pirajno et al., 2019).

Results and Discussions

Geochemistry of mineralization-bearing rocks The rock carrying the mineralization on the Beruang Kanan prospect is Porphyry Andesite. Rock geochemical data indicates that it is classified as an intermediate igneous rock that is rich in silica. Andesite silica composition is approximately 60% with a total alkali (Na+K) of around 3.6%. Based on these data, it is known that the dacite affinity is calc-alkaline (based on the diagram of (Rollinson, 2014). (Table 1) (Figure 1). The major elements and trace elements of the host rock were obtained from X-ray fluorescence (XRF) analysis and Plasma-Coupled Mass Spectrometry (ICP-MS) methods. The volcanic rocks of the Beruang Kanan prospect are primarily Andesite. Samples having an LOI value of less than about 2 wt% are assumed to be unaltered or fresh rock and these rocks are generally characterized by the presence of relative euhedral phenocrysts and mineral grains and the absence of secondary hydrothermal minerals. Andesite has a concentration of trace elements and the main ones have SiO2 (55.74- 59.91%), Al2O3 (15.65-17.87%), FeO * (tot) (4.06-5.38%), MnO (0.12-0.18%), MgO (2.11-3.85%), CaO (2.96-8.28%), Na2O (1.97-3.68%), and K2O (0.7-1.43%). (Table 1). This diagram provides a mobile element method of identifying arc lavas and their volcanic series. The triangular plot of Ti, Zr and Sr diagram (Pearce and Cann, 1973) (Figure 3) is used to confirm the tectonic environment of volcanic rocks. Based on the classification diagram, most of the source rocks are shown in the calc-alkaline series and fall in the andesite field.

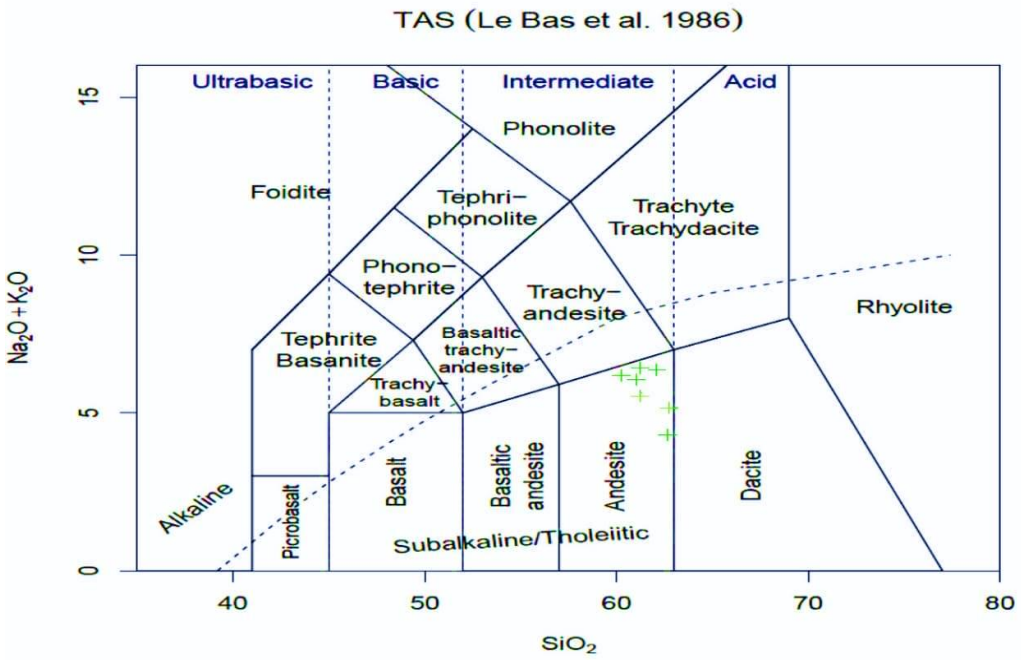

Figure 1. Volcanic rock classification plot diagram (Na2O + K2O vs SiO2) (after Le Bas et. Al., 1986). The line of division between alkaline and sub-alkaline rocks is from (Irvine & Baragar, 1971)

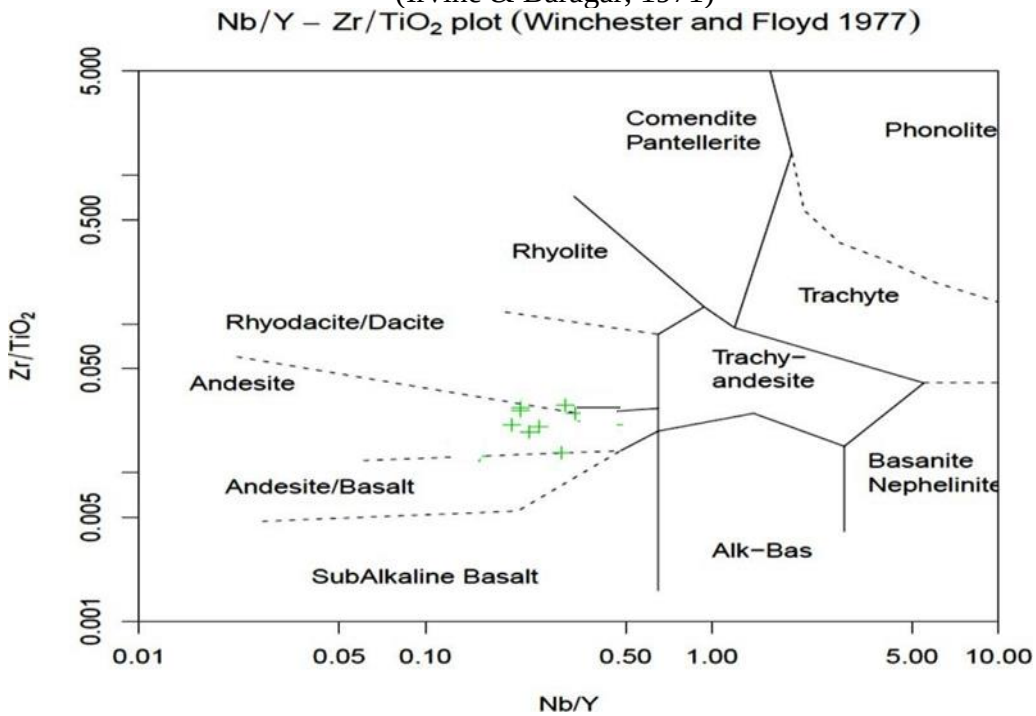

Figure 2. Zr/TiO2 vs Nb/Y Pearce diagram (1996) (after Winchester and Floyd, 1977)

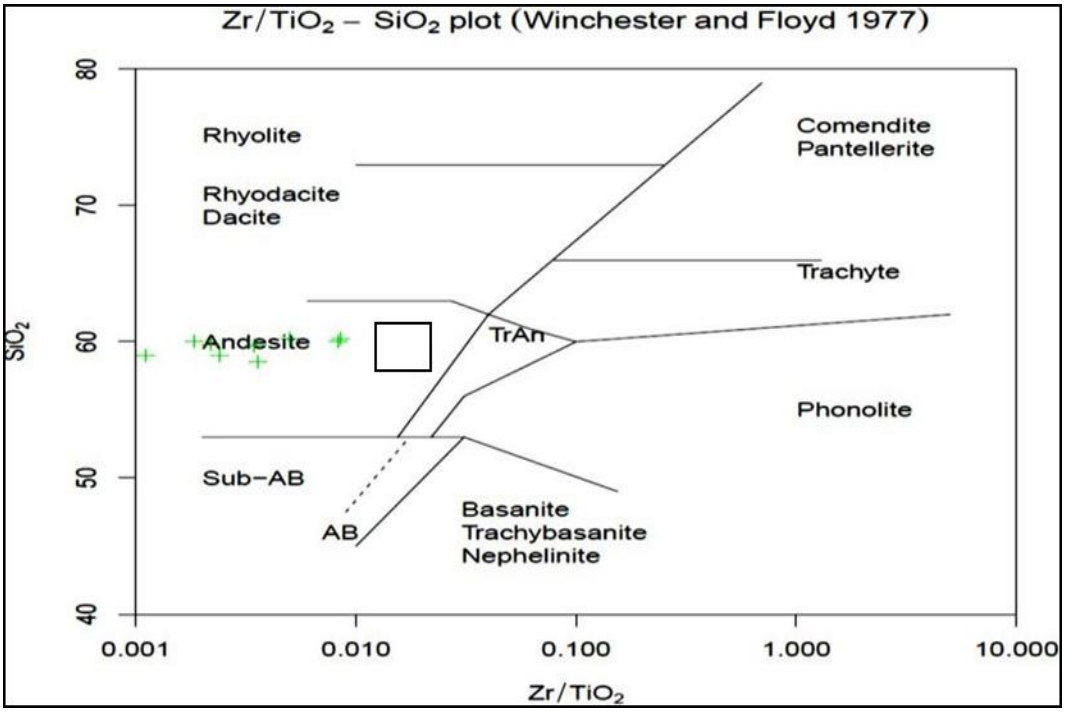

Figure 3. Identification of arc lavas and their volcanic series (SiO2 vs Zr/TiO2b ratio plot Winchester and Floyd, 1977)

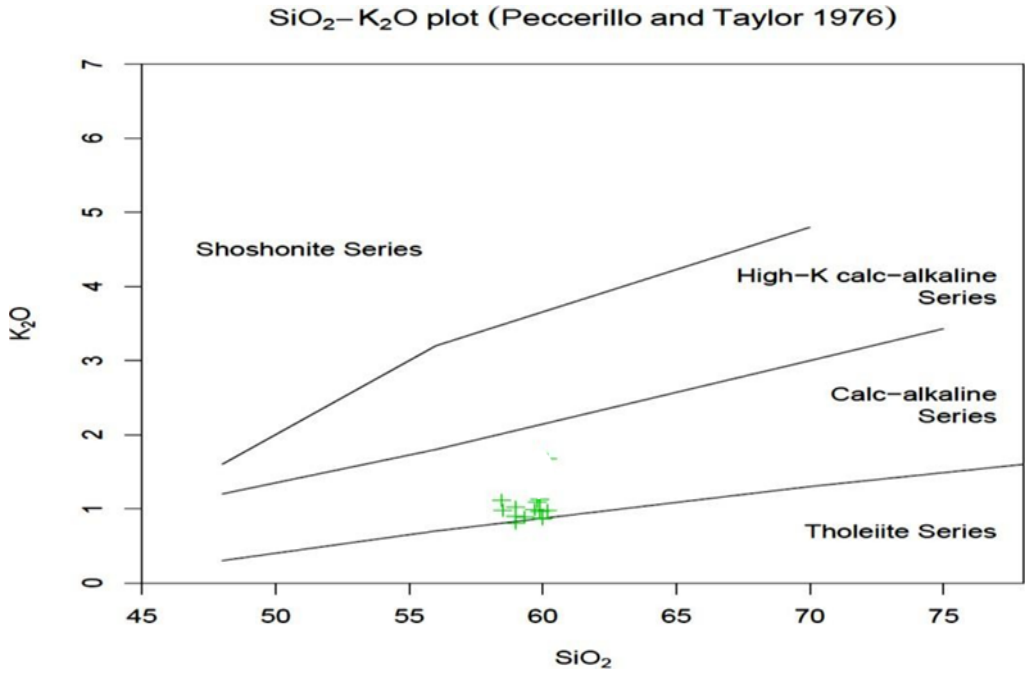

Figure 5. K2O vs SiO2 variation diagram (Pearce and Cann, 1973)

Discussion

The volcanic magmatic affinity in the study area is calc-alkaline (Figures 1-5), this chemical characteristic is clearly reflected by the type of volcanic rock which is determined based on its chemical classification, which is generally igneous rock of the calc-alkaline magma series type so it is interpreted to originate from a convergent tectonic environment continental margin (Bullock et al., 2018). Cal alkaline magmatic affinity of andesite intrusions in the form of Sintang breakthrough rocks. According to (Hartono,

2013), Sintang breakthrough rocks generally have a porphyritic texture with coarse-sized hypidiomorphic crystals. K/Ar rock analysis of the Sintang breakthrough rock produces an age of 30.4 to 16.4 Ma or Early Oligocene to Middle Miocene.

Conclusion

Changes/mineralization in the study area are guided by Tertiary calc-alkaline volcanic sequences and clastic volcanic rocks consisting of dacitic tuff and tuffaceous sandstone. The intermediate alkaline calc host rocks are consistent with magmatic rock associations generally associated with Intermediate Sulphidation epithermal deposits.

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