RELATION BETWEEN STRUCTURAL CONTROL AND GOLD MINERALISATION IN GNIMI-YABOGHAN, SOUTHWESTERN BURKINA FASO

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MINERAL EXPLORATION

Gold occurrence has been reported in different area of Burkina Faso. However, there has been no detailed studies on some of the area with reported occurrences of gold. This study was therefore carried out to investigate gold occurrence in Gnimi, Southwestern part of Burkina Faso. Airborne radiometric and aeromagnetic data was acquired and geological mapping was carried out on a scale of 1:50,000.Lithological identified during the field work were subjected to mineralogical studies while geochemical analysis was carried out using X-ray Fluorescence (XRF), inductively coupled plasma mass spectrometry while gold concentration was obtained using fire assay technique. Radiometric and aeromagnetic data revealed the presence of different lithologies and zones of hydrothermal alteration in the area which may be favorable for ore deposition with several lineaments trending NNW-SSE observed in the area .Geological mapping revealed the lithologies in the area are amphibolite, schistose rocks, granite and quartz veins. Mineralogical studies revealed the presence of quartz, feldspars and micas in the granitic rocks and several accessory minerals such as apatite, zircon and amphiboles as accessory minerals. In amphibolites, pyroxenes and amphiboles were identified as major minerals while ilmenite, rutile and titanite were identified as accessory mineral. Major oxide concentration (%) for granitic rocks revealed SiO_2 ranging from 66.99 to 71.49, Al_2O_3 from 14.23 to 15.32, Fe_2O_3 from 2.99 to 5.22, MgO 1.45 to 3.12, MnO 0.05 to 0.08, CaO 2.48 to 4.11, Na_2O 2.83 to 3.37, TiO_2 from 0.26 to 0.48 and K_2O 3.26 to 4.02 and P_2O_5 ranges 0.1 to 0.19%. The plot of SiO_2 vs Na_2O+K_2O,$Al_2O_3/(Na_2O+K_2O)$vs $Al_2O_3/(CaO+Na_2O+K_2O)$, Y vs Nb; and Y + Nb vs Rb revealed that the granites are calc -alkaline, peraluminous, S -Type which formed in a volcanic arc environment.Trace elements (ppm) in granites ranged : Ba<10 to 30, Ce 0.27 to 0.61, Co 0.2 to 0.6, Cu 1.9 to 9.2, Ni 1.2 to 4.6 , Rb 0.4 to 3.2, Sb 0.1 to 0.6, Sr 1.3 to 4.4 , Y 0.1 to 0.8 , Zr <0.5 to 3.9. The gold concentration are very low in granitoids and high in quartz vein with values ranging from <0.002 ppm to 9.9ppm.

Key words: Lineaments, Airborne geophysical, aeromagnetic, radiometric, lithologies, gold.

Word count: 352

COMPOSITIONAL CHARACTERISTICS OF PEGMATITES IN PARTS OF MZIMBA DISTRICT, NORTHERN MALAWI

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MINERAL EXPLORATION

Pegmatites are known worldwide to host economically important mineral deposits such as gemstones, industrial minerals and rare metals. Malawi's pegmatites have attracted significant interest due to its relation with major orogenic events. Mzimba pegmatites in northern Malawi are known for their gemstones and industrial minerals. However, their compositional characteristics and rare metal mineralization have not been researched. This study assessed the compositional characteristics of pegmatites from Danei Jere area, Mzimba district in northern Malawi. Mapping of pegmatites within the host rocks in the area was done on a scale of 1:50,000. Thin sections from the samples obtained were cut and studied under the petrological microscope. Major oxide composition of the pegmatites was determined using X-Ray Fluorescence (XRF) spectroscopy, while trace element compositions of whole rock (n=7), feldspar (n=5) and muscovite extracts (n=2) were done using Inductively-Coupled Plasma Spectroscopy (ICPMS) at ALS Laboratory, Canada. Subhedral to euhedral quartz, muscovite, microcline and plagioclase were the dominant minerals observed under petrographic microscope.

Major element compositions in the whole rock, feldspar and mica extracts samples were: SiO2 - 69.29- 87.79 (Mean, 76.58), 64.41-68.85 (Mean, 66.42) and 46.67-63.49 (Mean, 55.08); Al2O3: 6.44-17.27 (Mean, 13.53), 17.8521.79 (Mean, 18.91) and 21.08-33.87 (Mean, 27.48); and K2O: 0.87-8.16 (Mean, 4.41), 0.95-11.60 (Mean, 6.93) and 6.59-10.15 (Mean, 8.37), respectively. Some trace element compositions (ppm) in the whole rock, feldspar and mineral extracts samples were: Li-1.70-21.10 (Mean 6.37), 1.20-7.90 (Mean, 4.52) and 8.90-14.70 (Mean, 11.80). Cs-0.19-6.52 (Mean, 2.03), 0.25-11.2 (Mean, 3.7), 0.46-21.3 (Mean, 10.88). Rb-17.5-305 (Mean, 117.44), 21.6-468 (Mean, 180.6), 152.5-308 (Mean, 230.25) and Ba: 120-1670 (Mean, 785.71), 140-3780 (Mean, 1188) and 480-1590 (Mean, 1035).

Major oxides ratios plot the pegmatites along granitic field and trondhjemic field. The samples are peraluminous, plot in the field of late orogenic, syn-collision and post-orogenic setting; and have calcic, alkali-calcic and alkalic affinities. Trace element ratios and plot showed that the pegmatites are less fractionated and barren, of muscovite class, and are neither Ta prospective nor Ta mineralized. The comparison of rare element composition of the pegmatites with Average Crustal and calculated Threshold values revealed that there is no appreciable rare metal mineralization in the pegmatites.

Key Words: Pegmatites, Mzimba district, Malawi, rare metal, mineralisation

PETROGRAPHY AND GEOCHEMICAL STUDIES OF THE IRON ORE DEPOSIT AND ASSOCIATED ROCKS OF THE BOGOIN ARAE SOUTHWEST CENTRAL AFRICAN REPUBLIC

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MINERAL EXPLORATION

The Banded Iron Formation (BIF) in Central African Republic has been linked to the formation of the Congo Craton, but lies within the Central African Orogenic Belt (CAOB) that marks a Neoproterozoic suture zone between the Congo Craton to the south and the Saharan Metacraton to the north. Previous studies on the genesis of the iron oxides indicates that they were derived from a mafic parental magma. The aim of this research is to determine the mineralogical and geochemical characteristics of the iron ore deposit and associated rocks of the Bogoin area, Central African Republic.

Geological mapping on a scale of 1:25,000 was carried out around Bogoin area. Thirty-four representative rock samples including five iron ore samples were collected from outcrops. Twelve samples were prepared into thin and polished sections for petrographic and five samples for mineralogical study using XRD. Major, trace and rare-earth elements of the rocks and iron ores were obtained using inductively coupled plasma-mass spectroscopy for Geochemical analyze.

The Bogoin area is composed of granite-gneiss, calc-silicate gneiss, amphibolite, metadiorite, chlorite schist, mica schist and granite. The gneiss displays shoshonitic to high potassium, calc-alkaline, and magnesian traits, are enriched in Ba, Sr, Rb, Zr, and Zn. The negative REE (Eu) anomaly, suggesting a high degree of fractionation in a cogenetic magmatic suite. The granitic rocks, are likely products of post-collisional granites. The amphibolite, chlorite schist, and mica schist are tholeiitic. The Al2O3 versus Na2O, K2O plot shows that the rocks are metaluminous enriched in As, Ba, Cr, Ni, V, Zn, suggests that these rocks are from a mafic source. The calc-silicate rocks are elevated in CaO, MgO, Cr, Ni and Sr indicating that the samples probably originated from shallow seawater.

The iron ore could be classified as oxide facies, comprising alternating bands of quartz and goethite. Other mineral include clinochlore (chlorite), a clay mineral. Geochemical data indicated that Fe2O3(t) ranged from 97.29 to 97.90 %wt. The Al2O3-SiO2-Fe2O3 ternary diagram shows that the iron ore falls within the field of Precambrian BIF, enrichment in element such as As, Sb, V, Ba, and Y and suggest positive anomalie of Eu, Ce, La.

The Bogoin iron formation within the basement complex of southwest Central African Republic, occur within amphibolite, chlorite schist and micas schist. The iron ore deposits is therefore derived from greenstones of metavolcanic and metasedimentary origin.

Keywords: Amphibolites, Banded Iron Formation, Chlorite schist, Iron ore deposit, Goethite, Bogoin

GEOCHEMICAL CHARACTERISTICS AND RARE-METAL (LI-NB-TA) MINERALIZATION POTENTIAL OF PEGMATITES OF BABANLA AREA, SOUTHWEST NIGERIA

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MINERAL EXPLORATION

The global transitioning from a fossil fuel- to green energy-driven economy has necessitated a growing demand for energy metals and critical minerals to achieve net zero emissions. This demand has generated a renewed interest in exploration for pegmatites, which are parts of the primary hosts of these metals. The Precambrian Basement Complex of Nigeria shows geological favorability for Li-Cs-Ta (LCT) pegmatites, which host a wide range of these critical metals; however, a large number of these pegmatite bodies have not been geochemically characterized to ascertain their rare metal-bearing status. This study is therefore aimed at assessing the ore mineralization potential of pegmatite bodies of Babanla area of the Precambrian Basement Complex of southwest Nigeria.

Geological mapping of the area was carried out on scale of 1:25,000. Thin sections were prepared for petrographic studies. Major, minor and trace element contents of 8 whole-rock pegmatite, 8 K-feldspar, 12 muscovite and 8 lepidolite samples were determined using Inductively Coupled Plasma-Atomic Emission Spectroscopy/Inductively Coupled Plasma-Mass Spectrometry ((ICP-AES/ICP-MS). The data obtained were analyzed using descriptive statistics.

Field studies revealed that the pegmatites occur as flat-lying dykes and veins, intruding hornblende gneiss, biotite granite gneiss, biotite schist and muscovite schist of the area. The essential minerals in the pegmatites include microcline-perthite, albite, quartz, muscovite, while garnet, schorl, lepidolite, tourmalines, beryls, columbo-tantalite, zircon, and apatite are the accessory constituents. The chemical data showed the pegmatites to be siliceous (SiO_2≈72.3-76.8 wt.%), strongly peraluminous (A/CNK > 1.2) and possibly derived from S-type granites. The K_2O (1.24-8.6 wt.%) and Na_2O (1.9- 5.4 wt.%) showed wide variations among samples, while MgO (0.07 wt.%), CaO (0.56 wt.%), Fe_2O_3 (1.21 wt.%), MnO (0.03 wt.%), TiO_2 (0.01 wt.%), P_2O_5 (0.16 wt.%) are generally low. The whole-rock pegmatites showed moderate levels of rare-alkali (Li≈299; Rb≈271 and Cs≈64 ppm) and rare-metals (Sn≈22; Nb≈20; Ta≈ 15; Ga≈18 ppm). The K-feldspar showed modesty in rare-alkali (Li≈108; Rb≈2570 and Cs≈741 ppm) and rare-metals (Sn≈64; Nb≈45; Ta≈ 27; Ga≈30 ppm) contents; while muscovite correspondingly indicated elevated levels in rare-alkali (Li≈454; Rb≈5023 and Cs≈950 ppm) and rare-metals (Sn≈259; Nb≈241; Ta≈ 157; Ga≈421 ppm) contents. The pegmatite showed moderate degree in rare-alkali and rare-metal fractionations, as revealed in the K-Feldspar (K/Rb ≈43.77, K/Cs ≈165.91, Nb/Ta ≈1.29) and muscovite (K/Rb ≈17.45, K/Cs ≈119.83, Nb/Ta ≈1.55), The lepidolite showed moderate Li_2O (2.09 wt.%), Rb_2O (0.71 wt.%), and Cs_2O (0.41 wt.%.). The K/Rb vs. Rb, Cs, Zn

and K/Cs vs. Na_2O plots showed the pegmatites to mineralized and rare-metal bearing; while Rb vs. Ta, Ta vs. Ga, Ta vs. Cs, Ta vs Cs+Rb and Ta vs. K/Cs showed the promising columbo-tantalite mineralization status of the pegmatites and compares favorably with other rare-element pegmatites elsewhere in Nigeria.

Indications from field relations, rare-metal mineral assemblages and bulk chemical data suggest that the pegmatites are mineralized and belong to the lepidolite subtype of the Li-Cs-Ta (LCT) petrogenetic family.

Keywords: Pegmatites, Rare-metals, Mineralization potential, Babanla, Southwest Nigeria

AN INTEGRATED ANALYSIS OF PRISMA HYPERSPECTRAL IMAGERY AND AEROMAGNETIC DATA FOR POTENTIAL GOLD MINERALIZATION EXPLORATION IN MWANZA, MALAWI

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MINERAL EXPLORATION

The Kirk Range-Lisungwe Valley, Mwanza, Malawi is underlain by rocks of two Mesoproterozoic subdomains of the South lrumide Domain, with the southern segment of the Lilongwe Subdomain making up ~80% of the area and the Unango Subdomain occupying the southeast corner. Previous Studies in the area have suspected the main source of gold to be thin stringer-type quartz veins with no clearly defined potential areas of mineralization. The aim of this study is to map potential zones of gold mineralization in the area by employing an integrated analysis of satellite imagery and aeromagnetic data.

Hyperspectral imagery acquired by the PRecursore IperSpettrale della Missione Applicativa (PRISMA) satellite was used to map hydrothermal alteration minerals by employing spectral mapping techniques that include Spectral Angle Mapper (SAM) and Spectral Information Divergence (SID) in Environment for Visualising Images (ENVI). Aeromagnetic data was used to map the potential zones of mineralization by using Centre for Exploration Target grid and porphyry analysis, as well as depth estimation using spectral analysis with Oasis Montaj. Potential gold mineralization zones in the area were produced by integrating the structural complexity, porphyry structures, gold occurrences, and minerals map in the study, this was followed by ground truthing work that included field geology, petrographic analysis and limited XRF geochemical analysis.

The suspected hydrothermal alteration minerals mapped included kaolinite/smectite, goethite, nontronite, desert varnish, and rutile. The evaluation of SAM and SID effectiveness was assessed using confusion matrices with an overall accuracy (OA) of 75.989% and a Kappa coefficient (ϰ) of 0.743 for SAM, and an OA of 79.945% and a ϰ of 0.781 for SID, revealing occasional outperformance by either method. The identified hydrothermal alteration minerals originate from various alteration of different minerals, and it was also shown that some of the rocks in the areas mapped have undergone intense weathering. The mineral maps revealed that the zones of alteration mainly consist of kaolinite, whereas the eastern part consists of nontronite and goethite to the western part, indicating the potassic and argillic alteration types. About six zones were identified from the integrated analysis of hyperspectral imagery and aeromagnetic data which showed potential of mineralization. The structures in the area were found to dominantly trend NE – SW and the depth range to basement complex rocks which host potential mineralization veins was found to be 90.33m - 1416.40m. Limited geochemical data of quartz veins shows an average of 0.2 ppm gold anomalies from the identified zones. Gold bearing quartz veins have been observed to be in association with the gneisses and migmatites that make up the basement complex rocks in the area.

To ascertain its complete gold potential, comprehensive study encompassing geological, and geochemical surveys and analyses is required.

Keywords: hyperspectral, classification, aeromagnetic, structures, mineral alteration, Mwanza

MINERALOGY, GEOCHEMISTRY AND RADIOACTIVITY OF GRANITOIDS IN FROM PART OF SOUTHWESTERN NIGERIA

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MINERAL EXPLORATION

There is an increase in environmental interest in radionuclides as a result of the radiological risks associated with various geological materials, such as rocks, sand, and water. These resources may contain radionuclides that naturally spread throughout the earth; hence, this study investigated the mineralogy, geochemistry, and radioactivity of selected granitoids from parts of Southwestern Nigeria.

For this study, rock samples were collected from some aggregate quarry sites in Ore, Ofosu,Ogbolu, Ado-Iyin, Afao and Ikere- Ise, southwestern Nigeria. Petrographic studies of 18 samples and X-ray diffraction (XRD) as well as Scanning Electron Microscopy with a Dispersive X-ray Analyser (SEM-EDX) analysis of 15 samples were undertaken to determine rock mineralogy. A whole rock geochemical analysis of 20 representative samples of the rock units using Inductively Coupled Plasma Mass Spectrometry (ICP-MS) was done to determine major, trace, and REE concentrations. The various results obtained were analysed using standard geochemical plots and variation diagrams aided by MS Excel, GCDKIT, and ArcGIS software.

Granite gneiss, granite, amphibolite, and charnockite were the predominantly mapped rock units in the study area. The major minerals identified were biotite, hornblende, quartz, plagioclase, muscovite, microcline, orthoclase, and pyroxene, which were confirmed by the XRD results. The XRD diffractograms revealed the presence of mica, amphibole, k- feldspar, quartz and plagioclase. The geochemical analysis revealed that the major oxide compositions (wt%) of SiO_2, Al_2O_3, Fe_2O_3, MgO, CaO, Na_2O, K_2O, TiO_2, P_2O_5, and MnO in the rock units ranged from 49.58–70.15, 12.96–16.96, 1.63–12, 0.38–4.51, 1.44–7.46, 2.51-4.25, 1.78–5.51, 0.21–3.7, 0.12-1.23, and 0.12-1.18, respectively. The trace elements revealed higher values (ppm) for Ba, Sr, and Zr, with ranges of 672–2271, 114–910, and 214–1839. The REEs showed LREE enrichment for the granites and amphibolites.

Geochemical plots revealed that the granitoids are predominantly oxides of feroans, calcic-alkalic to alkalic-calcic and mostly metaluminous, indicating depletion in aluminium oxide, explaining the high composition of plagioclase feldspars and Hornblende minerals in them. The granitoids are LREE-enriched and HREE-depleted, as observed in the spider plots of the REEs, with negative Eu anomalies indicating fractional crystallization and plagioclase fractionation, respectively. Th/U ratio was observed with a maximum value of 16.19 which is considered highly radioactive Th- bearing granites. SEM-EDX revealed that the mineralisations are mainly: Zircon, Monazite, Titanite, Thorianite, Quicklime, Uraninite, Apatite, Ilmenite, Orthoclase and Samarskite.

Keywords: Radionuclides; Granitoids; Metaluminous; Granite gneiss; Fractional crystallization

Word count: 395

PETROGRAPHIC AND GEOCHEMICAL CHARACTERIZATION OF RARE METAL PEGMATITES AROUND OTUAM AND ABANDZE AREAS, SOUTHERN GHANA

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Mineral Exploration

Pegmatites because of their economic importance as host to rare metals and green or critical metals are now targets of intense exploration globally. Pegmatites in Ghana occur around Otuam and Abandze areas which are part of the Winneba - Cape Coast pegmatite field, and the Cape Coast granite complex which are associated with the metasedimentary rocks of the Birimian Supergroup. The pegmatites within the field are known to host mineralization such as columbite-tantalite, spodumene, tourmaline, rutile and cassiterite. Especially the Mankwadzi aplite-pegmatite rocks outcrop at Ejisumanku Hills and the Saltpond areas known for their spodumene content.

This study aims to assess the compositional features in relation to petrography and chemistry of the pegmatites and the associated rocks around the area. Outcrop and drill core samples were collected for pegmatites, aplites, granite, schist and amphibolite. 21 samples were submitted for petrographic analysis at the department of geology, University of Ibadan, and for whole rock geochemical analysis at the Australian Laboratory Services Laboratory. Major, trace and rare earth elements composition of the rocks were determined using Inductively Coupled Plasma-Mass Spectroscopy and Inductively Coupled Plasma-Atomic Emission Spectroscopy.

Results show that the pegmatites are highly siliceous with an average SiO_2 value of 74.182 wt.%, Al_2O_3 (15.316 wt.%), Na_2O (4.225 wt.%), K_2O (3.448 wt.%) and Fe_2O_3 (0.878 wt.%). Aluminium Saturation Index (ASI), given by the A/CNK values >1 (1.025 – 2.755) indicate that the granitic rocks are mildly to strongly peraluminous which crystallized from a fertile granitic melt and also of S-type. The pegmatites are enriched in rare metals Ta (0.20 – 69.60ppm), Nb (2.83 – 83.50ppm), Li (20.00 - >10000ppm), Sn (2.30 – 131.00ppm). They are complex rare-element class of the LCT type as they are enriched in the characteristic elements Li, Cs, Rb, Nb>/< Ta, (Sn, P). This assertion is supported by their peraluminous (A/CNK>1) and siliceous nature. They are moderately enriched in LREE (La, Ce, Pr, Nd, Pm, Sm and Eu) compared to HREE (Gd, Tb, Dy, Ho, Er, Tm, Yb, and Lu) which correlates with their fractionation. K/Rb values of the pegmatites range from 17.685 to 328.750. The pegmatites are of late-orogenic to post-orogenic settings. They also originate from syn-collisional, within plate and volcanic arc granites, which together with late-post orogenic settings, are common tectonic settings related to collisional settings.

Keywords: Pegmatites, Southern Ghana, Birimian, Lithium, Rare Metals.

GEOLOGICAL STUDIES AND GEOCHEMICAL CHARACTERIZATION OF ROCKS AND TOPSOILS OF THE NDABLAMA AREA, SOUTHWEST LIBERIA

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MINERAL EXPLORATION GEOSCIENCE

Liberia has the potential for many metallic deposits mostly hosted in greenstone belts, yet these belts remain highly unexplored. Studying the geochemical characteristics of the Ndablama area is essential for understanding the mineralization within the Ndablama greenstone belt and establishing a baseline study that can enhance exploration in similar belts within Liberia. Therefore, this study aimed to identify the lithological units, mineral assemblage, alteration, elements distribution, and association in rocks and soils to determine the geochemical characteristics of the Ndablama area and produce a geological map.

The study employed remote sensing, core logging, field mapping, rock sampling, soil sampling, petrographic, and geochemical analysis using the combination of ICP-OES and ICP-MS. Twenty-eight rock samples were studied under a light polarizing microscope. Twenty-two rock and twenty soil samples were sent to the Activation Laboratory in Canada for geochemical analysis.

Field mapping and petrography revealed that the Ndablama area underlain by Archean basement complex which comprises of granite gneiss and granite. These basement rocks have been intruded by the supracrustal(greenstone) belt of ultramafic and mafic units that have been metamorphosed. The greenstone belt contains late felsic intrusions which include granites, pegmatite, and quartz. There are also relict of gneisses along with late granitic intrusions within the Greenstone belt. The Ndablama area has undergone regional and contact metamorphism as seen by foliation and hydrothermal alterations. The mineral assemblages reflect that of greenschist to amphibolite facies metamorphism. Both rock orientation and structural lineament support the NE to SW trend.

Geochemical analysis revealed that ultramafic and mafic rocks were of subalkaline magma that underwent fractional crystallization resulting in calc-alkaline series ranging from basalt to dacite emplaced within mid-ocean ridge and island arc. Trace element concentration showed that ultramafic rocks were enriched in Sc, Cr, Co, Ni, Cu, and Zn, while mafic rocks were enriched in Sc, Be, V, Cr, Co, Ni, Cu, and Zn. Granitic rocks were mostly of calc-alkaline series being emplaced by volcanic arc activities of pre-, syn-, and post-collision type. These rocks range from granite to granodiorite in composition with enrichment of trace and REEs in gneisses and granites while the quartz and pegmatite were depleted of trace and REEs.

The soil within the Ndablama area showed enrichment of Al (80663), P(53), V (44ppm), Cr (532ppm), Mn (3723034), Fe (40666) Ni (169ppm), Cu (25ppm), Zn (29ppm) and Ga (24ppm) reflecting similar anomaly as the underlain rocks. The soil anomaly mainly reflects that of ultramafic rocks. Almost all of the enrichment in soil were underlain by ultramafic and mafic units except Ga which was underlain by the basement granite. These anomalous values were as the result of weathering of the underlain bedrock.

Keywords: Greenstone belt, Metamorphism, Geochemical, Alteration, Ndablama

PETROLOGY, GEOCHEMICAL AND ECONOMIC CHARACTERIZATION OF RARE METALS-BEARING PEGMATITES OF NTEGA-MARANGARA AREA, NORTHEASTERN BURUNDI

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Ntega-Marangara area, part of the Kanyaru supergroup, Western Domain (WD) of Karagwe Ankole Belt (KAB) hosts numerous pegmatite veins related to the 986 ± 10 Ma leucogranite. Previous studies in some adjoining areas showed Nb-Ta-, Sn-, and W- mineralization in granite-related pegmatites and quartz veins. These studies were however not extended to the Ntega-Marangara area, northeastern Burundi. The aim of this investigation is to determine the petrology, geochemistry and rare metal mineralization potential of the pegmatite and associated granitoids, including their altered equivalents in Ntega-Marangara area.

Geological mapping on a scale of 1:25,000 was carried out around Ntega-Marangara area. Representative samples (13), consisting of kaolinised pegmatites (9), leucogranites (2), unaltered pegmatite (1) and greisenised pegmatite (1) were collected from outcrops and subjected to petrographic analysis. Major, trace and rare-earth elements of the rocks and their altered derivatives were determined using inductively coupled plasma-atomic emission spectroscopy, and inductively coupled plasma-mass spectroscopy. Geochemical discrimination diagrams were processed using Microsoft office excel and GCD kit tool for the production of variation diagrams used in data interpretation.

The lithological units mapped specifically for rare metal mineralization in the area include unaltered pegmatite, kaolinised pegmatite, greisen, and the host leucogranite, which intrude metapelites (mainly mica schists and quartzites). Quartz, plagioclase, microcline, and muscovite are the essential minerals in both the pegmatite and leucogranite. The Alumina Saturation Index (A/CNK) values of 1.78 and 1.62 for the unaltered pegmatites and leucogranite, respectively, indicated the peraluminous character. The ΣREE of the pegmatite and leucogranite are 147 and 102 ppm, respectively. The Rb, Cs, Ta, Li, Nb and Sn values of 5,940, 1015, >2500, 130, 1,595, and 671 ppm, respectively in the greisen are higher than the corresponding values of 636, 62, 32, 74, 58 and 110 ppm of the kaolinized pegmatites. This enrichment has been used to classify them as Lithium-Cesium-Tantalum (LCT) pegmatite. The mean values of K/Rb, K/Cs, and Nb/Ta are 106.86, 2819.24, and 4.30 in the leucogranite, 35.33, 469.47, and 3.1 in the pegmatite, and 14.05, 82.2, and 0.64 in the greisen, respectively. Pegmatite of Ntega-Marangara area is enriched in LREE relative to HREE with K/Rb ratio <100, indicating a high level of fractionation and mineralisation in contrast to the leucogranite that is less fractionated and barren. The greisenisation due to metasomatic reactions of late hydrothermal activity could have increased the potential for rare metals mineralisation of the altered pegmatite. The pegmatite and leucogranite intruded mesoproterozoic metasediments with NE-SW trending fractures, generated by brittle deformation in quartzite and axial ductile deformation in metapelites. These NE-SW dominant fractures are cut across by N-S and NW-SE trending fractures, indicating post-magmatic tectonic events, predisposing the pegmatite to hydrothermal alteration. The Rb vs Y+Nb, Nb vs Y, Rb vs Ta+Yb and Ta vs Yb diagrams suggested that the granitoids could have evolved from a magma generated in a syn-collisional orogenic setting.

The pegmatite of Ntega-Marangara area is derived from a highly fractionated magma from a syn-collisional orogenic setting. The pegmatite is partly greisenised and Ta, Nb, Cs, Sn and Li mineralized.

Keywords: Leucogranite, LCT pegmatite, Hydrothermal alteration, Greisen, Rare-metal, Ntega-Marangara