Article title: The Geochemistry Of Matrix Of Metaconglomerate In Igarra South-Western, Nigeria
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ABSTRACT

Geochemical exploration of Igarra district within the Igarra schist belt in southwestern Nigeria was carried out using geological field mapping with the aim of determining the elemental composition of the matrix in metalonglomerate. A total of 15 samples were collected. Chemical analysis of 11 trace elements (Cr, Mn, Ni, Ti, V, Sr, Pb, Ba, La, Zn, and Cu) and 7 major elements (P, K, Al, Mg, Fe, Ca, and Na) were carried out. The analytical results were subjected to univariate statistical analysis in order to determine the elemental compositions of the matrix via histogram. There are different in the concentration and percentage in the trace element and major element respectively in (MB1 to MB15). Barium has the highest and Titanium has the lowest in the elemental distribution of the trace element while Phosphorus has the highest and Sodium has the lowest in the elemental distribution of the major elements. Two individual trace element (Manganese and Lanthanium) show similarity in their concentration in (ppm) throughout the samples (MB1 and MB15). Magnesium and Strontium are below the detection limit in the geochemical analysis data, i.e. they are extremely low in the elemental composition of the matrix. From the geochemical analysis, the trace element is more abundance than the major element in the matrix of metalonglomerate. The occurrence of pathfinder elements such as Nickel and Lead within the schist belt that could serve as hosts for mineralization of these elements, provides a strong basis for this assertion.
INTRODUCTION

1.1 General Statement

A comparative geochemistry studying of the different rocks available on earth is an important part to understanding their economic importance and benefits to humanity which is the essence of most, if not all geoscientific studies. Recent methods advancements as extended our reach as geoscientists, into more elaborate studies that help us to derive elements and minerals of importance in rocks through the use of specific geochemical analytical procedures. The three major rock types in the world (igneous, sedimentary and metamorphic) occur together in close vicinity at Igarra area. The present study is part of the stage of the systematic prospecting programme, which is a regional geochemistry study of the drainage systems of the Igarra schist belt. This stage is aimed at outlining broad areas of high mineralization potential for a follow up action (Bradshaw et al., 1972). Metaconglomerate is one of the major lithological successions within the study area. Metaconglomerate is formed when conglomerate is subjected to metamorphism. It is easily identifiable by its pebbly and cobble clasts set in a matrix of sand, silt or clay. The cement matrix of conglomerate is not as durable as the grains, and hence when broken, conglomerate breaks around the grains. Protoliths of metamorphic rocks include virtually the entire spectrum of magmatic and sedimentary rocks as well as previously metamorphosed rocks, including diverse metasomatic ones. Only sedimentary evaporates and rare highly alkaline magmatic rocks are seemingly not represented (Best, 2003). Metaconglomerate, however, breaks through the grains, as the cement has recrystallized and may be as durable as the clasts. It is a coarse-grained rock containing rounded to sub-angular
Fragments that are greater than 2 mm in diameter and distributed in a fine-grained matrix of metamorphic minerals. Original primary sedimentary structure such as bedding is no more evident but clasts which show physical stretching and mineralogical changes are prominent features. Conglomerate rock is a mix of large and small grains and is siliciclastic sedimentary rock. It is also comprised of small rock pieces held together by a fine-grained matrix. Metaconglomerate rock is made of the same components, but has undergone one or more various types of metamorphism (Land, 2017). Previous geological research works on the study area, reported the metaconglomerate as a unit in the lithologic sequence. The focus of this thesis work is on the geochemistry of matrix in metaconglomerate of Igarra schist belt.

Most mineral deposits were reported to consist of a central zone, or concentric bodies, in which the valuable elements or valuable minerals are concentrated, often in percentage quantities, to a degree sufficient to permit economic exploitation. The valuable elements surrounding ore-body are generally described to depreciate in concentration until they reach levels, measured in parts per million or per billion (ppb), which automatically is higher than the normal background level of the enclosing rocks (Baedecker, 1987).

Previous studies on geochemistry of metamorphic rocks has been on calc-silicate rock which entails on the grade of metamorphism with respects to the minerals assemblages in them (Ikoro., et al, 2012). There have been many research works on the geochemistry of different metamorphic rocks in the study area but none of the researchers have study the geochemistry of the matrix of metaconglomerate in the study area.
In this work, determination of the trace and major elements in the matrix of metaconglomerate of the study area was studied using X-ray powder diffraction (XRD) analysis and ICP-MS technique stems.

GEOLOGICAL SETTLING

Igarra, the area of study lies between latitude 7° 10” N and 7° 20” N and longitude 6° 00” E and 6° 00” E. It is situated about 167.8 kilometers (Km) northeast (NE) of Benin City, the capital of Edo state. Igarra lies in the northern part of Edo State and is the headquarters of Akoko Edo Local Government Area. The major highway in the area runs from Auchi through, Sobe Ogbe, Ikpeshi, and Igarra to Ibillo. Both the old and new roads were used as access path for the exercise. There are also other major footpaths which are indicated in the accessibility map and access to outcrops was mostly by 5 footpath as many outcrops occur in places inaccessible to vehicles. Some outcrops were also situated close to residential areas and thus, gives more reason to access them via foot.

Igarra and its environs comprises mainly of igneous, metasediment, and metamorphic rocks. Igarra area, lies within the southwestern Nigerian basement which itself is a part of the Nigerian Basement Complex. The Nigerian Basement Complex is also a part of the Pan African mobile belt that lies between the West African craton to the east and the Congo craton to the southwest within the African continent. Most parts of the study area is underlain by the meta-sediments, referred to as the Igarra Schist Belt, which presumably overlies an older gneiss-migmatite 12 basement, possibly of Liberian age. The metasedimentary succession in Igarra area consists predominantly of pelitic to semi-pelitic rocks of low to medium grade metamorphism. Major
rock types exposed in the area include (i) semi-pelitic phyllite; (ii) quartz-biotite schist; (iii) mica schist; (iv) calc-silicate gneiss and marble; and (v) meta-conglomerate; all of which have been deformed in at least two episodes.

The Nigerian basement complex lies within the pan Africa mobile belt to the east of West Africa craton and craton of Congo craton. The Nigerian basement complex can be divided into two provinces.

1. The western province approximately west of latitude 80 E is characterized by narrow sediment dominated N-S trending low schist belts in a predominately migmatite-gneiss “Older” basement and whole was Intruded by pan Africa granitic plutons.


A research through reports and journals suggest that detailed works have not been done on the geochemistry of matrix of metaconglomerate in the study area. However, many works have been done to delineate the different rock types in the study area and many other detailed petrological research works have been done. In order to evaluate the geochemistry of metaconglomerate in the Igarra area, it is therefore tentative to understand the geological setting of Nigeria and the formation of the Igarra schist belt on which the Igarra is situated. The Geology of Nigeria is made up of three major petro-lithostratigraphical components:

1. Sedimentary Basins: Cretaceous to Recent < 145 million years

2. Younger Granites: Jurassic 200 – 145 million years
3. Basement Complex: Pan-African and older (Precambrian) > +600 million years

Figure 1: Geological map of study area.
2.0 MATERIALS AND METHODS

2.1 Fieldwork and sampling
The geological mapping of the area was done by traversing the area essentially on foot through existing roads and footpath. Outcrop encountered on the field were located on the topographic map with the aid of the GPS readings, observation were also recorded in the filed notebook. Rock samples were collected using either sledge hammer or geologic hammer. The compass was used in measuring dip and strike. The sample were well labelled to correspond with each locality visited before packed into the sample bag for further geochemical analysis. Physical characteristics of the rocks are color, textures, and various geological structures were recorded for each locality.

2.2 Laboratory preparation
Before sending samples to geochemical labs for elemental analysis, it is important to pulverize and weigh samples. The rock sample is sorted out according to each locations with well labelled. 2g of each of the 15 samples was packaged in a sealable polythene packs and double-sealed with extra packs. The whole packages were then gently placed in a Kraft paper and well addressed. Then the samples were sent to the laboratory for pulverization.

After the pulverization, 2g of each of the 15 samples were send to the laboratory for the geochemical analysis. As the routine practice with rock and core, the entire sample is crushed to
a nominal minus 2g, mechanically split (riffle) to obtain a representative sample and then pulverized to at least 95% minus 105 microns (µm). All of steel mild steel and do not induce Cr or Ni contamination.

As a routine practice, we will automatically use cleaner sand between each samples. Quality of crushing and pulverization is routinely.

This technique is useful for major, minor, trace, and REE's with the exception of Boron which is added during the digestion procedure to complex hydrofluoric acid.

The procedure consists of taking approximately 0.15 g of rock powder (weighed to the nearest 0.0001 grams into a 30 ml Teflon sleeve provided by CEM Corp. The sleeve is placed into a Pyrex 30 ml vial and 4 ml of conc. trace metal grade Nitric Acid, 1 ml of deionized water, 1.5 ml of conc. trace metal grade Hydrochloric Acid, and 1.5 ml of conc. trace metal grade Hydrofluoric acid are added. The vial is capped and microwaved in a CEM Corp Discover SP-D microwave unit. The ramp time is 6 minutes and the hold time is 4 minutes at 150°C. After cooling the system is vented and digested again. The ramp time is 6 minutes and the hold time is 8 minutes at 200°C. After cooling 12 ml of a 4% (by weight) Boric Acid solution is added followed by 10 ml of deionized water. The resulting solution is mixed by magnetic stirring and reweighed before transferring to a 30 ml Teflon bottle. The solution weight divided by the original sample weight yields the dilution factor. This solution is diluted 20 times more for major element analysis on the ICP-OES, or 5-10 times for trace element analysis on the ICPMS.

3.0 RESULTS AND DISCUSSION

The geochemical data obtained from the analysis of the rock samples are presented in forms of table and histogram plots. The selected elements for the purpose of this geochemical study are:
Chromium, Manganese, Nickel, Titanium, Vanadium, Strontium, Lead, Phosphorus, Barium, Lanthanium, Aluminium, Potassium, Sodium, Magnesium, Iron, Zinc, Copper, and Calcium.

For the aim of this study, 18 (listed above) out of the 33 elements detectable by the AQ-300 analytical procedure are given specific focus and studied for their economic importance and possible exploration. The elemental concentration for the selected 18 elements is presented in Table 1.

Geochemical results for all the samples were presented in histograms (Figure 2 to 15).

Table 1. Raw data of the concentration and percentage of trace and major element

<table>
<thead>
<tr>
<th>SAMPLE LABELING</th>
<th>Cr (ppm) 1</th>
<th>Mn (ppm) 2</th>
<th>Ni (ppm) 1</th>
<th>Ti (ppm) 0.001</th>
<th>V (ppm) 1</th>
<th>Sr (ppm) 1</th>
<th>Pb (ppm) 1</th>
<th>Al (%) 0.01</th>
<th>Na (%) 0.01</th>
<th>Mg (%) 0.01</th>
<th>Zn (ppm) 1</th>
<th>Cu (%) 0.01</th>
<th>Ca (%) 0.01</th>
</tr>
</thead>
<tbody>
<tr>
<td>MB1</td>
<td>ROCK PULP</td>
<td>50</td>
<td>7</td>
<td>9</td>
<td>0.213</td>
<td>0.71</td>
<td>&lt;0.5</td>
<td>52</td>
<td>27</td>
<td>165</td>
<td>0.02</td>
<td>0.77</td>
<td>&lt;2</td>
</tr>
<tr>
<td>MB2</td>
<td>ROCK PULP</td>
<td>104</td>
<td>21</td>
<td>17</td>
<td>0.314</td>
<td>1.06</td>
<td>0.6</td>
<td>65</td>
<td>26</td>
<td>98</td>
<td>21</td>
<td>3.17</td>
<td>2.64</td>
</tr>
<tr>
<td>MB3</td>
<td>ROCK PULP</td>
<td>53</td>
<td>17</td>
<td>5</td>
<td>0.166</td>
<td>0.36</td>
<td>&lt;0.5</td>
<td>20</td>
<td>29</td>
<td>9</td>
<td>17</td>
<td>1.07</td>
<td>0.69</td>
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<tr>
<td>MB4</td>
<td>ROCK PULP</td>
<td>80</td>
<td>13</td>
<td>9</td>
<td>0.207</td>
<td>0.95</td>
<td>&lt;0.5</td>
<td>40</td>
<td>23</td>
<td>75</td>
<td>13</td>
<td>1.89</td>
<td>1.66</td>
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<tr>
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<td>ROCK PULP</td>
<td>99</td>
<td>23</td>
<td>11</td>
<td>0.258</td>
<td>1.62</td>
<td>&lt;0.5</td>
<td>49</td>
<td>23</td>
<td>114</td>
<td>23</td>
<td>2.76</td>
<td>1.93</td>
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<tr>
<td>MB6</td>
<td>ROCK PULP</td>
<td>68</td>
<td>13</td>
<td>11</td>
<td>0.243</td>
<td>1.41</td>
<td>&lt;0.5</td>
<td>51</td>
<td>28</td>
<td>66</td>
<td>13</td>
<td>2.67</td>
<td>1.88</td>
</tr>
<tr>
<td>MB7</td>
<td>ROCK PULP</td>
<td>38</td>
<td>24</td>
<td>12</td>
<td>0.147</td>
<td>0.3</td>
<td>&lt;0.5</td>
<td>66</td>
<td>19</td>
<td>100</td>
<td>24</td>
<td>1.68</td>
<td>1.13</td>
</tr>
<tr>
<td>MB8</td>
<td>ROCK PULP</td>
<td>52</td>
<td>18</td>
<td>7</td>
<td>0.17</td>
<td>2.03</td>
<td>&lt;0.5</td>
<td>28</td>
<td>18</td>
<td>39</td>
<td>18</td>
<td>2.96</td>
<td>1.41</td>
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<tr>
<td>MB9</td>
<td>ROCK PULP</td>
<td>103</td>
<td>6</td>
<td>13</td>
<td>0.316</td>
<td>0.49</td>
<td>0.5</td>
<td>65</td>
<td>21</td>
<td>145</td>
<td>6</td>
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<td>ROCK PULP</td>
<td>97</td>
<td>14</td>
<td>13</td>
<td>0.271</td>
<td>0.98</td>
<td>&lt;0.5</td>
<td>58</td>
<td>17</td>
<td>163</td>
<td>14</td>
<td>2.67</td>
<td>2.4</td>
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<tr>
<td>MB11</td>
<td>ROCK PULP</td>
<td>53</td>
<td>55</td>
<td>4</td>
<td>0.093</td>
<td>0.74</td>
<td>&lt;0.5</td>
<td>16</td>
<td>21</td>
<td>33</td>
<td>55</td>
<td>1.23</td>
<td>0.6</td>
</tr>
<tr>
<td>MB12</td>
<td>ROCK PULP</td>
<td>71</td>
<td>15</td>
<td>8</td>
<td>0.208</td>
<td>2.48</td>
<td>&lt;0.5</td>
<td>38</td>
<td>17</td>
<td>83</td>
<td>15</td>
<td>2.36</td>
<td>1.52</td>
</tr>
</tbody>
</table>
Figure 2: Element distribution in the matrix for location 1
Figure 3: Element distribution in the matrix for location 2

Figure 4: Element distribution in the matrix for location 3
Figure 5: Element distribution in the matrix for location 4

Figure 6: Element distribution in the matrix for location 5.
Figure 7: Element distribution in the matrix for location 6.
Figure 8: Element distribution in the matrix for location 7.

Figure 9: Element distribution in the matrix for location 8.
Figure 10: Element distribution in the matrix for location 9.

Figure 11: Element distribution in the matrix for location 10.
Figure 12: Element distribution in the matrix for location 3.

Figure 13: Element distribution in the matrix for location 5.
Figure 14: Element distribution in the matrix for location 6.

Figure 15: Element distribution in the matrix for location 7.
Figure 16: Element distribution in the matrix for location 2.
3.3 INTERPRETATION OF RESULT

The objective of the statistical analysis and interpretation of geochemical analysis is to recognize among the study samples, the amount of trace elements and major elements present in the rock sample. In this work, the results of the statistical analysis of geochemical data and distribution of the elements (Histogram) were carefully studied and interpreted. The presentation are presented below.

A critical study of the raw data listing plots Figure 2 to 16 revealed the fifteen elements were distributed. The distribution of these trace and major elements in the study area varies in concentration (ppm) and percentage (%) respectively.

From the figure 2, the trace and major elements in MB1 varies in concentration (ppm) and percentage (%) respectively. The trace element present in MB1 are Cr, Mn, Ni, Ti, V, Sr, Pb, Ba, La, Zn, and Cu. Barium (Ba) has the highest concentration of (165ppm) in the composition of the trace elements present in MB1 while Titanium (Ti) has the lowest concentration (0.213ppm) in MB1. The major elements are P, Al, K, Na, Mg, Fe, and Ca. Phosphorus (P) has the highest percentage of (27%) in the composition of major element in MB1 while Sodium (Na) has the lowest percentage of (0.01%) in MB1.

From the figure 3, the trace and major elements in MB2 varies in concentration (ppm) and percentage (%) respectively. The trace element present in MB2 are Cr, Mn, Ni, Ti, V, Sr, Pb, Ba, La, Zn, and Cu. Chromium (Cr) has the highest concentration of (104ppm) in the composition of the trace elements present in MB2 while Titanium (Ti) has the lowest concentration (0.213ppm) in MB2.
Concentration (0.314ppm) in MB2. The major elements are P, Al, K, Na, Mg, Fe, and Ca. Phosphorus (P) has the highest percentage of (26%) in the composition of major element in MB2 while Sodium (Na) has the lowest percentage of (0.07%) in MB2.

From the figure 4, the trace and major elements in MB3 varies in concentration (ppm) and percentage (%) respectively. The trace element present in MB4 are Cr, Mn,, Ni, Ti, V, Sr, Pb, Ba, La, Zn, and Cu. Chromium (Cr) has the highest concentration of (53ppm) in the composition of the trace elements present in MB3 while Titanium (Ti) has the lowest concentration (0.106ppm) in MB3. The major elements are P, Al, K, Na, Mg, Fe, and Ca. Phosphorus (P) has the highest percentage of (29%) in the composition of major element in MB1 while Sodium (Na) has the lowest percentage of (0.04%) in MB3.

From the figure 5, the trace and major elements in MB4 varies in concentration (ppm) and percentage (%) respectively. The trace element present in MB4 are Cr, Mn,, Ni, Ti, V, Sr, Pb, Ba, La, Zn, and Cu. Chromium (Cr) has the highest concentration of (80ppm) in the composition of the trace elements present in MB4 while Titanium (Ti) has the lowest concentration (0.207ppm) in MB4. The major elements are P, Al, K, Na, Mg, Fe, and Ca. Phosphorus (P) has the highest percentage of (23%) in the composition of major element in MB4 while Sodium (Na) has the lowest percentage of (0.02%) in MB4.

From the figure 6, the trace and major elements in MB5 varies in concentration (ppm) and percentage (%) respectively. The trace element present in MB5 are Cr, Mn,, Ni, Ti, V, Sr, Pb, Ba, La, Zn, and Cu. Barium (Ba) has the highest concentration of (114ppm) in the composition of the trace elements present in MB5 while Titanium (Ti) has the lowest concentration
The major elements are P, Al, K, Na, Mg, Fe, and Ca. Phosphorus (P) has the highest percentage of (23%) in the composition of major element in MB4 while Calcium (Ca) has the lowest percentage of (0.053%) in MB5.

From the figure 7, the trace and major elements in MB6 vary in concentration (ppm) and percentage (%) respectively. The trace element present in MB6 are Cr, Mn, Ni, Ti, V, Sr, Pb, Ba, La, Zn, and Cu. Chromium (Cr) has the highest concentration of (66ppm) in the composition of the trace elements present in MB6 while Titanium (Ti) has the lowest concentration (0.243ppm) in MB6. The major elements are P, Al, K, Na, Mg, Fe, and Ca. Phosphorus (P) has the highest percentage of (28%) in the composition of major element while Calcium (Ca) has the lowest percentage of (0.043%) in MB6.

From the figure 8, the trace and major elements in MB7 vary in concentration (ppm) and percentage (%) respectively. The trace element present in MB7 are Cr, Mn, Ni, Ti, V, Sr, Pb, Ba, La, Zn, and Cu. Barium (Ba) has the highest concentration of (100ppm) in the composition of the trace elements present in MB7 while Titanium (Ti) has the lowest concentration (0.147ppm) in MB7. The major elements are P, Al, K, Na, Mg, Fe, and Ca. Phosphorus (P) has the highest percentage of (19%) in the composition of major element while Sodium (Na) has the lowest percentage of (0.03%) in MB7.

From the figure 9, the trace and major elements in MB8 vary in concentration (ppm) and percentage (%) respectively. The trace element present in MB8 are Cr, Mn, Ni, Ti, V, Sr, Pb, Ba, La, Zn, and Cu. Chromium (Cr) has the highest concentration of (52ppm) in the composition of the trace elements present in MB8 while Titanium (Ti) has the lowest concentration (0.17ppm) in MB8. The major elements are P, Al, K, Na, Mg, Fe, and Ca. Phosphorus (P) has
the highest percentage of (18%) in the composition of major element while Calcium (Ca) has the lowest percentage of (0.047%) in MB8.

From the figure 10, the trace and major elements in MB9 varies in concentration (ppm) and percentage (%) respectively. The trace element present in MB9 are Cr, Mn, Ni, Ti, V, Sr, Pb, Ba, La, Zn, and Cu. Barium (Ba) has the highest concentration of (145ppm) in the composition of the trace elements present in MB9 while Titanium (Ti) has the low concentration (0.316ppm) in MB9. The major elements are P, Al, K, Na, Mg, Fe, and Ca. Phosphorus (P) has the highest percentage of (21%) in the composition of major element while Sodium (Na) has the lowest percentage of (0.02%) in MB9.

From the figure 11, the trace and major elements in MB10 varies in concentration (ppm) and percentage (%) respectively. The trace element present in MB10 are Cr, Mn, Ni, Ti, V, Sr, Pb, Ba, La, Zn, and Cu. Chromium (Cr) has the highest concentration of (163ppm) in the composition of the trace elements present in MB10 while Titanium (Ti) has the lowest concentration (0.271ppm) in MB10. The major elements are P, Al, K, Na, Mg, Fe, and Ca. Phosphorus (P) has the highest percentage of (17%) in the composition of major element while Sodium (Na) has the lowest percentage of (0.02%) in MB10.

From the figure 12, the trace and major elements in MB11 varies in concentration (ppm) and percentage (%) respectively. The trace element present in MB11 are Cr, Mn, Ni, Ti, V, Sr, Pb, Ba, La, Zn, and Cu. Manganese and Lanthanium has the same highest concentration of (55ppm) in the composition of the trace elements present in MB11 while Titanium (Ti) has the lowest concentration (0.093ppm) in MB11. The major elements are P, Al, K, Na, Mg, Fe, and Ca.
Phosphorus (P) has the highest percentage of (21%) in the composition of major element while Calcium (Ca) has the lowest percentage of (0.052%) in MB11.

From the figure 13, the trace and major elements in MB12 varies in concentration (ppm) and percentage (%) respectively. The trace element present in MB12 are Cr, Mn, Ni, Ti, V, Sr, Pb, Ba, La, Zn, and Cu. Barium (Ba) has the highest concentration of (83ppm) in the composition of the trace elements present in MB12 while Titanium (Ti) has the lowest concentration (0.208ppm) in MB12. The major elements are P, Al, K, Na, Mg, Fe, and Ca. Phosphorus (P) has the highest percentage of (17%) in the composition of major element while Calcium (Ca) has the lowest percentage of (0.048%) in MB12.

From the figure 14, the trace and major elements in MB13 varies in concentration (ppm) and percentage (%) respectively. The trace element present in MB13 are Cr, Mn, Ni, Ti, V, Sr, Pb, Ba, La, Zn, and Cu. Barium (Ba) has the highest concentration of (59ppm) in the composition of the trace elements present in MB13 while Titanium (Ti) has the lowest concentration (0.201ppm) in MB13. The major elements are P, Al, K, Na, Mg, Fe, and Ca. Phosphorus (P) has the highest percentage of (24%) in the composition of major element while Calcium (Ca) has the lowest percentage of (0.036%) in MB13.

From the figure 15, the trace and major elements in MB14 varies in concentration (ppm) and percentage (%) respectively. The trace element present in MB14 are Cr, Mn, Ni, Ti, V, Sr, Pb, Ba, La, Zn, and Cu. Barium (Ba) has the highest concentration of (86ppm) in the composition of the trace elements present in MB14 while Titanium (Ti) has the lowest concentration (0.139ppm) in MB14. The major elements are P, Al, K, Na, Mg, Fe, and Ca. Phosphorus (P) has the highest percentage of (17%) in the composition of major element while Sodium (Na) has the lowest percentage of (0.03%) in MB14.
From the figure 16, the trace and major elements in MB15 varies in concentration (ppm) and percentage (%) respectively. The trace element present in MB15 are Cr, Mn, Ni, Ti, V, Sr, Pb, Ba, La, Zn, and Cu. Chromium (Cr) has the highest concentration of (121ppm) in the composition of the trace elements present in MB15 while Titanium (Ti) has the lowest concentration (0.361ppm) in MB15. The major elements are P, Al, K, Na, Mg, Fe, and Ca. Phosphorus (P) has the highest percentage of (29%) in the composition of major element while Sodium (Na) has the lowest percentage of (0.03%) in MB15.

The plots show the dominant trace and major element in each rock samples. It was observed from histogram chart that chromium and barium has the highest dominance in concentration (ppm) in trace elements in all the sample (MB1-MB15) while titanium has the lowest limit in the sample (MB1-MB15) in concentration (ppm) in trace elements in all the sample (MB1-MB15). For major elements, it was observed that phosphorus has the highest rate of percentage (%) in major element in all the sample (MB1-MB15) while Sodium has the lowest limit in the sample (MB1-MB15) in percentage (%) in major elements in all the sample (MB1-MB15).

Hence, (MB11-MB15) sample were obtained five locations (3, 5, 6 , 7 and 2)

**Variation of elements from MB11 to MB15:**

1. MB11 (The sample is obtained from location 3)

For concentration of MB11, Highest = Manganese (55ppm) and Lanthanium (55ppm)

Lowest = Titanium (0.093ppm)

For major element of MB11 Highest = Phosphorus (21%)

Lowest = Calcium (0.052%)
For concentration of MB3, Highest = Chromium (53ppm)

Lowest = Titanium (0.106ppm)

For major element of MB3 Highest = Phosphorus (29%)

Lowest = Sodium (0.04%)

Variation of element between MB11 and MB3 together.

The two samples MB11 an MB3, MB11 have two of the similar trace elements of the similar concentration (ppm) and highest concentration of MB3 to be Chromium (53ppm).

For major element, the two samples MB11 and MB3, have highest similar major element (Phosphorus 21% and 29%) but differences in percentage (%), while sample MB11 and MB3 have the different major element (Calcium 0.052% and Sodium 0.04%) with difference in percentage (%)

2. MB12 (The sample is obtained from location 5)

For concentration of MB12, Highest = Barium (83ppm)

Lowest = Titanium (0.208ppm)

For major element of MB12 Highest = Phosphorus (17%)

Lowest = Calcium (0.048%)

For concentration of MB5, Highest = Barium (114%)

Lowest = Titanium (0.0258%)

For major element of MB5 Highest = Phosphorus (23%)
Lowest = Calcium (0.053%)

Variation of element between MB12 and MB5 together.

The two samples MB12 an MB5, have two different particular highest trace element (Barium but differences in concentration in (ppm), while MB12 and MB5 have two different particular lowest trace element called Titanium, but difference in concentration.

For major element, the two samples MB12 and MB5, have the two different particular highest major element (Phosphorus) but differences in percentage (%), while sample MB12 and MB5 have the different particular lowest major element calcium, but difference in percentage (%).

MB13 (The sample is obtained from location 6)

For concentration of MB13, Highest = Barium (59ppm)

Lowest = Titanium (0.201ppm)

For major element of MB13 Highest = Phosphorus (24%)

Lowest = Calcium (0.036%)

For concentration of MB6, Highest = Chromium (66ppm)

Lowest = Titanium (0.243ppm)

For major element of MB6 Highest = Phosphorus (28%)

Lowest = Calcium (0.043%)

Correlate MB13 and MB6 together
After correlate, the two samples MB13 and MB6, have two highest trace elements Barium (59ppm) and Chromium (66ppm) respectively in the same parent rock. Hence, it shows that rocks with the same parent rock have different trace element composition, despite the parent rock is been split into two samples MB13 and MB6. But the lowest trace elements in MB13 and MB6 have the same particular trace element (Titanium) but difference in concentration values.

For major elements, the two samples MB13 and MB6 have two different particular highest major element (Phosphorus (17%) and (28%)) but difference in percentages (%) values. While the lowest percentage (%) in the sample MB13 and MB5 are the same major element but different percentage (%). They are Calcium (0.036%) and Calcium (0.043%) respectively.

MB14 (The sample is obtained from location 7)

For concentration of MB114, Highest = Barium (86ppm)

Lowest = Titanium (0.139ppm)

For major element of MB14 Highest = Phosphorus (17%)

Lowest = Sodium (0.03%)

For concentration of MB7, Highest = Barium (100ppm)

Lowest = Titanium (0.147ppm)

For major element of MB7 Highest = Phosphorus (19%)

Lowest = Sodium (0.03%)

Correlate MB14 and MB7 together
After correlate the two samples MB14 an MB7, they have two different particular highest trace element (Barium 86ppm and 100ppm) respectively but differences in concentration in (ppm). The two samples MB14 an MB6. They also have two different particular lowest trace element (Titanium 0.139ppm and 0.147ppm) respectively but differences in concentration in (ppm).

For the major element, the two samples MB13 and MB6, they have two different particular highest trace element (Phosphorus 17% and Phosphorus 19%) respectively and different in percentage (%). They also have the same particular lowest trace element (Sodium 0.03% and Sodium (0.03%) respectively with the same percentage value in percentage (%).

MB15 (The sample is obtained from location 2)
For concentration of MB115, Highest = Chromium (121ppm)
Lowest = Titanium (0.361ppm)
For major element of MB15 Highest = Phosphorus (29%)
Lowest = Sodium (0.03%)
For concentration of MB2, Highest = Chromium (104ppm)
Lowest = Titanium (0.314ppm)
For major element of MB2 Highest = Phosphorus (26%)
Lowest = Sodium (0.07%)

Correlate MB15 and MB2 together

After correlate the two samples MB15 an MB2, they have two different particular highest trace element (Chromium 121ppm and Chromium 104ppm) respectively but differences in
concentration in (ppm). They also have two different particular lowest trace element (Titanium 0.361ppm and 0.314ppm) respectively but differences in concentration in (ppm).

For the major element, the two samples MB15 and MB2, they have two different particular highest major element (Phosphorus 29% and Phosphorus 26%) respectively and different in percentage (%). They also have two different particular lowest major element (Sodium 0.03% and Sodium (0.07%) respectively with the same percentage value in percentage (%).
4.0 CONCLUSION

The statistical techniques were adopted to interpret the geochemical data generated from the study area. A subtle agreement from the method of interpretation enabled one to arrive at a logical conclusion. The histogram plots of all the elements reveal the probability distribution of a continuous variable of the trace elements (Cr, Mn, Ni, Ti, V, Sr, Pb, Ba, La, Zn, and Cu) except (P, Al, K, Na, Mg, Fe, and Ca), which are major elements present in the matrix of metaconglomerate.

Also, the histogram distribution of all of the elements shows the abundance distribution which may be interpreted as indicating multiple populations of the trace and major elements. This probably indicates the samples were derived from heterogeneous underlying rocks in the study area.

For trace elements (Cr, Mn, Ni, Ti, V, Sr, Pb, Ba, La, Zn and Cu), barium has the highest abundant of trace element in each of the sample MB1-MB15.

In addition, La and Mn has the same values of their individual trace element concentration in each of MB1-MB15. However, Sr and Zn concentration is below the detection limit concentration for the analysis, so Sr and Zn in the matrix of the metaconglomerate is extremely low to the least trace element that is above the detection limit which is titanium. There are difference in concentration in trace element from each MB1-MB15. The arrangement of trace element according to the highest to lowest is (Ba, Cr, Pb, La, Mn, Ni, V, Ca, Ti), while Sr and Cu is sometimes above or below the detection limit and Zn is completely below the detection limit. The overall arrangement for the above and below the detection limit of trace element is (Ba, Cr, Pb, La, Mn, Ni, V, Ca, Ti, Cu, Sr and Zn). For major element (P, AL, K, Na, Ng, Fe and
Ca), P has the highest abundance of major element in each of the sample MB1-MB15, while Ca has the lowest abundance of major element in each sample of MB1-MB15. Fe concentration is below the detection limit of the analysis.

The geochemical analysis carried out revealed that there are different in the concentration and percentage in the trace element and major element respectively in (MB1 to MB15). From the geochemical analysis, the trace element is more abundance than the major element in the matrix of metalonglomerate.
REFERENCES


