Full Length Research Paper

Patterns and Significance of Geosciences and Mining Research Works in Nigeria from 2008-2012

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ABSTRACT

This work attempts to statistically analyze the patterns of research works presented as technical papers/abstracts under the umbrella of Nigerian Mining and Geosciences Society (NMGS) conferences over five years from 2008-2012, with the objective of recognizing both the major and minor patterns/trends and their significance. The total number of works analyzed was 697. The data sources were the NMGS books of abstracts. The research works are categorized into sixteen geoscientific sub-disciplines, as well as twelve geological provinces of Nigeria. For various sub-disciplines covered the highest number of research works came from geophysics with 18.88%, followed by hydrogeology/hydrology 10.73%. The least were crystallography/mineralogy 1.43% and geochemistry/regional geology 0.72%. In the category of geological provinces the highest number came from the Niger Delta with 24.34%, followed by the southwest basement complex and northwest/central basement regions with 19.46% and 18.08% respectively. The least number of works came from the northeast basement (Hawal Massif) 0.68% and Sokoto Basin 0.17%. Multiply authored works had majority of 324, followed by double authorship with 252, and singly authored works with120. Factor identified to have contributed to the high or low volume of research in the various sub-disciplines and geologic provinces include the country's level of technological development, level of economic activities in a region, concentration of geosciences/mining departments or institutions in particular areas, versatility of some sub-disciplines than others, etc. It is hoped that this research findings would assist our geoscience professionals and policy makers in the extractive industry to extend attention to all areas in order to stimulate research and fast track growth of the extractive industry. This will generate job opportunities for our young geoscience and mining graduates.

Keywords: geosciences, mining, research, statistics, technical papers.

INTRODUCTION

This work attempts to bring together in summary from geosciences and mining research works presented as technical papers, lead papers and abstracts in the annual international conferences **of** the Nigeria Mining and Geosciences Society (NMGS) from 2008 to 2012. The objective is to identify and present dominant areas or sub-disciplines of research and also to recognized areas within Nigeria's geological provinces with high or low volumes of research. Minor sub-disciplines are also identified. An attempt is made also to explain why we have the high or low volumes of research works from the respective geological provinces and sub-disciplines.

Table 1: Research papers presentation from 2008-2012 based on sub-disciplines of geosciences/mining, (sources NMGS abstract volumes 2008-2012).

S/N	Sub-disciplines	Authorship 2008-2012			Total No. Papers Presented in:					Total No. Of papers per sub-discipline presented (2008-2012)	Percentage of papers per sub-disciplines (2008-2012)
		Single	Double	Multiple	2008	2009	2010	2011	2012		
1	Cryt. & Mineralogy	1	2	7	2	3	1	3	1	10	1.43
2	Ign. & Meta. Petrology	4	10	5	2	7	2	4	4	19	2.71
3	Geochemistry	5	28	29	10	13	9	17	13	62	8.87
4	Economic Geology	15	19	19	3	11	11	6	22	53	7.58
5	Geochron. & Reg. Geology	-	3	2	-	2	2	1	-	05	0.72
6	Struct. Geol. & Geotectonics	9	20	11	9	12	9	3	7	40	5.72
7	Sed. Geol. & Stratigraphy	10	21	23	5	19	7	15	8	54	7.72
8	Energy Resource & Development	9	9	16	2	13	5	3	11	34	5.01
9	Paleon., Palyno.& Biostrat.	7	10	23	3	11	12	13	1	40	5.72
10	Quart. Geol. & Phy. Geology	10	7	11	5	11	2	9	1	28	4.00
11	Geophysics	14	45	73	17	25	14	27	49	132	18.88
12	Hydrogeology & Hydrology	13	24	38	8	19	9	23	16	75	10.73
13	Eng. Geology & Geotechnics	9	25	30	1	14	11	20	18	64	9.15
14	Min. Process. & Material Sc.	1	-	7	-	3	-	1	4	08	1.14
15	Metallurgy & Mining Geology	1	4	5	2	2	-	4	2	10	1.43
16	Environ. & Agric Geology	12	25	25	2	14	17	17	12	62	8.87
	Total	**120**	**252**	**324**	**71**	**179**	**111**	**166**	**169**	**696**	**100**

Table 2: Research papers presentation from 2008-2012 based on Nigeria's geological provinces (sources NMGS abstract volumes 2008-2012).

S/No.	Nigerian Geological provinces	Total No. of Paper Presented in:					Total No. Of papers per sub-discipline presented (2008-2012)	Percentage of papers per sub-disciplines (2008-2012)
		2008	2009	2010	2011	2012		
1	Western Basement Complex	15	21	8	30	41	115	19.46
2	Northwest/ North Central Basement Complex	12	19	19	31	26	107	18.08
3	Northeastern (Hawal) Basement Complex	-	-	1	2	1	4	0.68
4	Eastern (Obudu/ Adamawa) Basement Complex	3	6	2	-	4	15	2.54
5	Southeastern Basement Complex	2	-	3	3	2	10	1.69
6	Benue Trough	10	15	10	10	10	55	9.30
7	Niger Delta	13	44	26	29	32	144	24.34
8	Sokoto Basin	-	1	-	-	-	1	0.17
9	Bornu Basin	1	6	3	4	3	17	2.87
10	Mid-Bida Basin	-	4	-	10	5	19	3.21
11	Anambra Basin	3	27	17	13	7	67	11.32
12	Dahomey Basin	3	6	6	13	9	37	6.25
	Total	**62**	**149**	**95**	**145**	**140**	**591**	**100**

The choice of the five years period 2008-2012 is not based on any statistical data but on the data available to the authoring team. However it is considered that the period is of considerable duration for reasonable deductions to be made from the presentation. It is hoped that the results of this work would assist our geosciences and mining professionals in the industry and academia, as well as policy makers/implementers in the extractive industry to intensify effort and/or extend their attention to all areas to fast track and sustain growth in the geosciences sector of Nigeria's economy. This is because no sustainable growth is achievable without quality investment in research and development.

METHODOLOGY

The data sources are the NMGS volumes of abstracts from 2008-2012. A total of 697 works were used for this analysis over the years in view. The works are categorized into sixteen geo-scientific/mining sub-disciplines and twelve geological provinces of Nigeria. In the sub-disciplines category, of authorship of works (single, double, and multiple) for each of the five years is also presented. The total number of papers per sub-disciplines and its percentage for five years are equally given. Tabulated results of these are presented.

In the geological provinces category, the total presentations per year for each province is given over the for five years, and its percentage with respect to all the provinces is also given. A total of 591works were analyzed.

In preparing this work there were some research papers/abstract that could not be classified into any geological province because of their general nature e.g. a paper titled "Towards an integrated seismic hazard monitoring in Nigeria using geophysical and geodetic technique" and another "Packaging geology for small

scale industries," also "A study of the effects of geophagy among women and children in Nigeria," among others. Such papers were not included in the analysis because they did not fit into any particular geological provinces of the country. The results of the study are presented using simple statistical charts.

RESULTS

A Table of categorization of works done based on sub-disciplines is presented as Table 1. From the Table a total of 120 works were done by single authors over the five years period, 252 were double authored while multiple authorship (≥ 3) accomplished 324 works. A total presentation of 71, 179, 111,166 and169 were made for each of the five years respectively. The total number of presentations was 696. Also from the Table, the highest volume of research works came from geophysics with 132 or 18.88%, this was followed by hydrogeology/hydrology with a total of 75 or 10.73%.

In the intermediate group were engineering geology/geo-technics with 64 work (9.15%), environmental and agricultural geology with 62 works (8.87%), geochemistry with 62 works (8.87%), sedimentary geology and stratigraphy 54 (7.72%), economic geology 53 (7.58%).

The low level group had geochronology and regional geology with 5 works (0.72%), crystallography/mineralogy with 10 works (1.43%), metallurgy and mining engineering 10 (1.43%), igneous and metamorphic petrology 19 (2.71%), mineral processing and material sciences had 8 (1.14%), quarternary geology/physical geology 28(4.0%), energy resources and development 34 (5.01%), structural geology/ geotectonic, and paleontology, palynology and biostratigraphy had 40 works each (5.72% respectively). The percentage distribution per sub-disciplines is shown as a bar chart in Fig.1.

The second table (Table 2) presents the research categorization by geological provinces. Topping these Table are works on the Niger delta 144 (24.34%), southwestern basement complex 115 (19.46%), northwestern / central basement complex 107 (18.08%), Anambra basin 67 (11.32%0, Benue Trough 55 (9.3%), Dahomey embayment 37 (6.25%). Middle Bida (Nupe) basin 19 (3.21%), Bornu basin 17 (2.87%). The lowest number of researches came from the eastern basement complex (Obudu/Adamawa) with 15 (2.54%), southeastern basement complex (Oban) 10 (1.69%), northeastern basement complex (Hawal) 4 (0.68 %), and Sokoto basin with only one work (0.17%). The total

research works across all provinces for each of the five years was 62, 149, 95, 145 and 140 respectively. Amounting to 591 for the period. The percentage distribution of works per geological province is shown as a histogram in Fig. 2.

DISCUSSION

In Table 1 and Fig.1, geophysics accounts for the highest percentage of the works done (18.88%). This can be explained in terms of the versatility of this branch of geosciences. Since its principles are utilized to image the subsurface, its applications affect all exploration areas. It is used in petroleum exploration, in hydrogeology, archeology, mineral exploration and engineering geology. It is also a useful tool in environmental geology, regional tectonics studies etc. Hydrogeology/ hydrology account for 10.73 %. Nigeria's population is drilling of boreholes constantly on the increase at a growth rate of 3% (2006 estimate).With a generally inefficient public water supply infrastructure, individuals and corporate groups have resorted to drilling of boreholes to meet their water supply demands. Hence this can be said to have contributed to the high level of hydrogeological researches. Engineering geology/geotechnics account for 9.15%. This field is required in foundation studies for building and construction, gulley erosion management, railway construction, dam construction etc. Presently we are witnessing a construction boom in the country. This possibly accounts for its relative high percentage. Since issues of the environment are usually topical especially when degradation is involved, researches in environmental geology and geochemistry came next with 8.87% each. Geochemistry is a sub-discipline that finds application in environmental studies, petroleum exploration, solid mineral exploration, hydrogeology and petrology. This may account for its relatively high percentage in Table 1. Economic geology with a percentage of 7.58 is probably so because of the rising interest in developing the solid mineral sector. The sub-disciplines of sedimentary geology / stratigraphy, paleontology/palynology/biostratigraphy and energy resources development are all soft rock based. Their percentages are 7.72, 5.72 and 5.01 respectively with a total of 18.45%. The total percentage of 18.45 for these fields has to do with sustained and intensive research in the sedimentary basins for hydrocarbon and other energy sources such as coal. A percentage of 5.72 for structural geology may be due to the paucity of structural geologist in the country compared to other sub-disciplines. This

Table 3. Distribution of universities with geoscience and mining courses. Data source: J.A. M. B. brochure 2008.

S/NO	GEOLOGICAL PROVINCES	NO. OF INSTITUTIONS WITH GEOSCIENCS COURSES
1	Southwestern Basement Complex	12
2	Northwest/Central Basement Complex	4
3	Northeastern (Hawal) Basement Complex	0
4	Eastern (Obudu/Adamawa) Basement Complex	0
5	Southeastern (Oban) Basement Complex	0
6	Benue Trough	2
7	Niger Delta	6
8	Sokoto Basin	0
9	Bornu Basin	1
10	Mid-Bida Basin	1
11	Anambra Basin	7
12	Dahomey Embayment	1
TOTAL		**34**
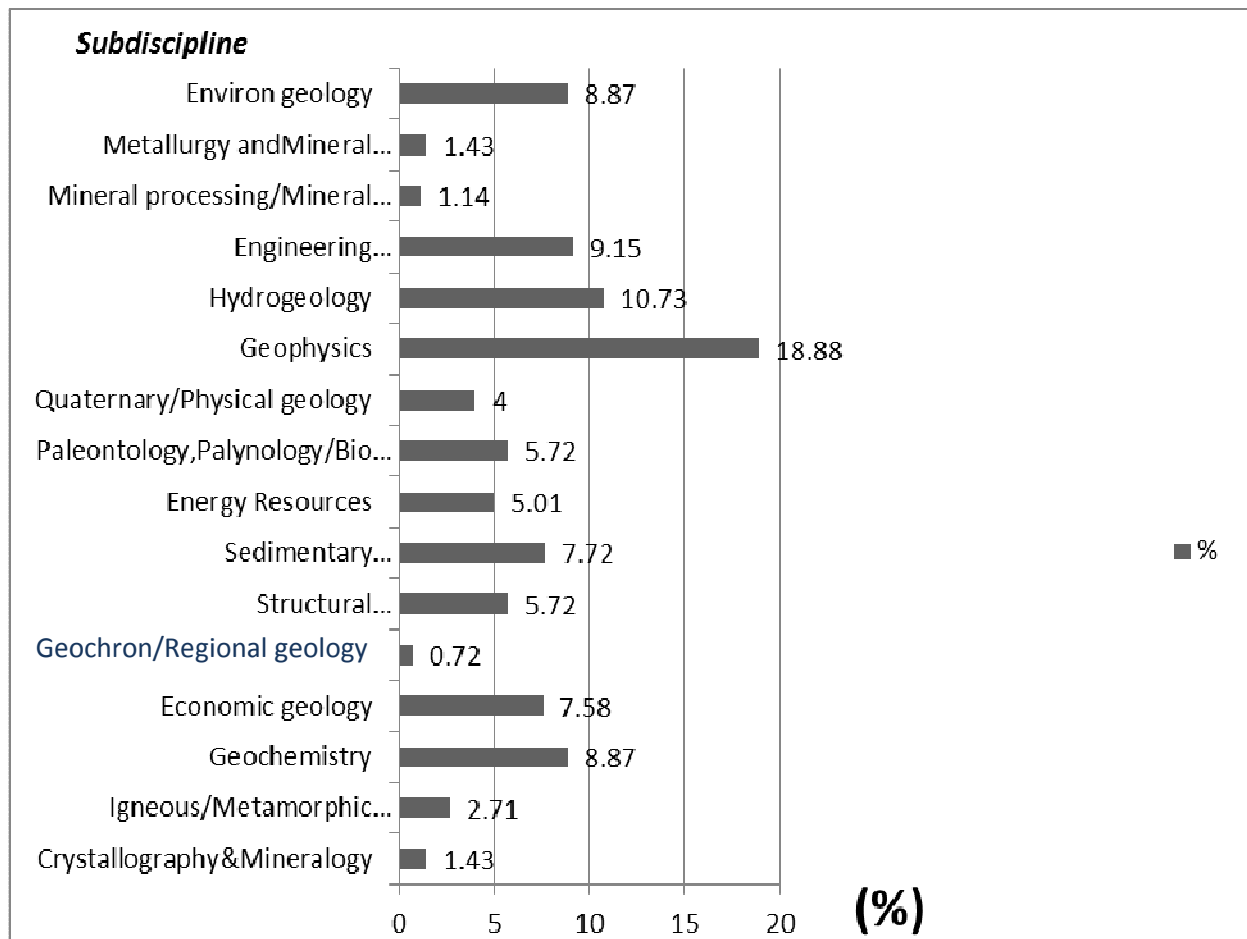
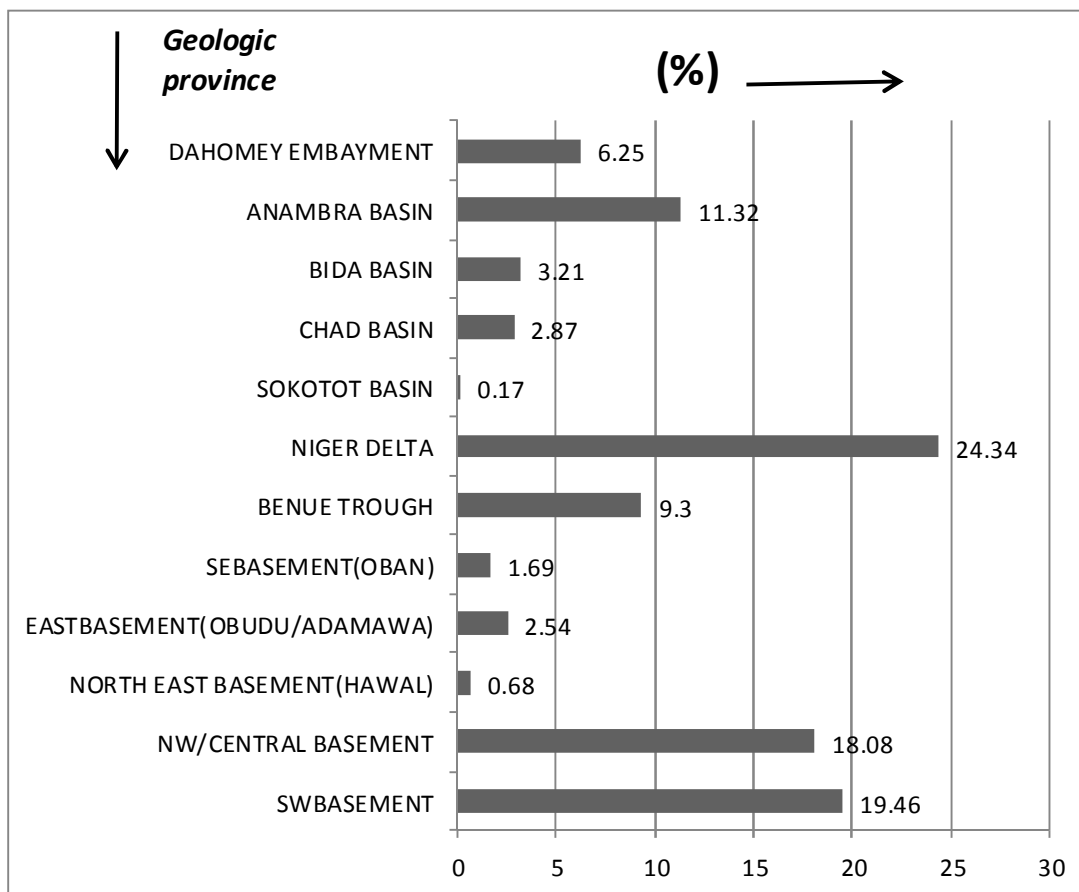**Fig. 1**. Percentage distribution of geosciences and mining researches by sub-disciplines

Fig. 2. Percentage distribution of geosciences and mining research works over geologic provinces.

ultimately reflects in the paucity of equipment for structural analysis in our institutions. There are relatively few igneous and metamorphic petrologists in the country and this reflects in the low volume of research (2.71%) in these areas. The same can be said of crystallography and mineralogy (1.43%). The volumes of works in metallurgy and mining engineering, mineral processing and material science are 1.43% and 1.14% respectively. These are so possibly because the steel plants and steel rolling mills at Ajaokuta, Warri, Oshogbo, Katsina and Jos locations are either not producing or producing at low capacity.

The number of universities located in the different geological provinces offering geoscience and mining courses seems to contribute to the volume of researches emanating from such provinces. An attempt to establish this was made by examining those institutions as published in the Joint Admissions and Matriculations Board (Nigeria's agency for admitting candidates into higher institutions of learning) brochure (2008) vis a viz the geological provinces they are located. There are a total of 34 of such institutions. A tabulated result is presented in Table 3. There are very few polytechnics that offer mining/mineral science courses in the country, and their number will not significantly alter the results shown here.

In Table 3 the highest concentration of institutions is in the southwest basement area with 12. Anambra Basin has 7, Niger Delta 6 while the Northwest/central basement has 4. On comparison with Fig. 2 the southwest basement province, Niger Delta, Northwest/central basement and Anambra Basin have the highest volume of works. It can therefore be said that the high number of such institutions in these areas contribute to the high number of research works from these geological provinces. Another factor that may contribute to the high volume of works in the southwest and Niger Delta is the high level of economic activities

within the regions. Some major economic hubs of the nation such as Lagos and Port Harcourt are located in these regions respectively.

The low volumes of research in some parts of the country may have to do with the relatively low technological and investment (especially mineral extraction) levels in the country compared to its foreign counterparts (Canada,China,South Africa Australia etc). These have made the vast amounts of solid minerals known to occur in these places to remain largely untapped. Examples are the Kalambina Formation of Sokoto Basin with large deposits of limestone (Badejoko,2009) and the large limestone deposits within the Dahomey Embayment (from Shagamu to Shango Ota). These can be exploited for cement making and such will motivate research and development.

CONCLUSION

This work is an attempt to assess research trends/patterns and factors that influence them in the geosciences community in Nigeria. The work has highlighted dominant research areas such as geophysics, hydrogeology, engineering geology etc. It has also identified geological provinces of the country were high or low volumes of research works emanate. On the high side are the petroliferous Niger Delta, the Southwest basement and the Northwest/central basement regions. Factors that influence the researches include high level of economic activities in some regions, high concentration of institutions offering geosciences/mining courses and

the relatively low level of technological / investment levels development in in the country. It is hoped that this research findings would assist our geoscience professionals and policy makers in the extractive industry to extend attention to all areas in order to stimulate research and fast track growth of the extractive industry. This will generate job opportunities for our young geoscience and mining graduates.

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