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Petrographic Characteristics of Basement Rocks in A few Bore Holes of Upper Assam Basin

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ABSTRACT

Detail Petrographic studies of fourteen borehole samples of the basement rock of Dibrugarh, Tinsukia and Sivasagar District of Upper Assam have been made. Two subsurface samples of gneissic rocks of Sylveta area of Karbi-Anglong district of Assam which are supposed to be the exposed equivalent of the hidden basement rock of Upper Assam basin were also studied. Petrographic study reveals that the basement rock of the borehole samples are Granite gneiss, Biotite-gneiss and Porphyritic Granite types. The granite gneisses are predominantly composed of quartz, feldspars with or without hornblende and some biotite flakes while the biotite gneisses are dominated by biotite, quartz and minor amounts of feldspar with or without hornblende. The granites are mostly porphyritic in nature and exhibited by myrmekitic texture. Large phenocrysts of microcline are common. The mineralogy and texture of all the borehole samples resemble the characteristics of the gneissic and granitic samples of Sylveta area, the northeastern most part of Assam-Meghalaya Plateau. A very important feature in the sample of borehole- Lohali-1 is that a patch of fine grained volcanic rock is found to occur in the granitic rock. This volcanic rock is a part of metavolcanics and composed mainly of actinolite, pyroxene (feathery), sodic plagioclase with sub-schistose texture.

KEYWORDS: Basement, gneiss, granite, volcanic, Shillong Plateau, Lesser Himalaya, IMR.

1. INTRODUCTION

The basement rocks of Upper Assam Basin are considered to be of Precambrean age and may be the extension of the rocks of Karbi Anglong district of Assam- the north- easternmost extension of Assam-Meghalaya plateau and comprising mainly of granite, granite gneiss, biotite gneiss, hornblende-biotite gneiss with pyroxene granulite, dolerite and amphybolite. But these rocks in Upper Assam basin are concealed under thick cover of Cenozoic sediments and occur as tectonic high with structural down warp country both to the north-west and to the south-east (Baruah et al 1992).

Information on the petrographic characteristics of these subsurface basement rocks of Upper Assam Basin is not available and may be due to not taking up of such studies so far. Hence, in order to have idea about petrography of these subsurface rocks fourteen (14) borehole samples (Table-1) have been studied. The study reveals that the basement rocks of the borehole samples are granite gneiss, biotite gneiss and porpyritic granite types. The granite gneisses are predominantly composed of quartz, feldspars with or without hornblende and some flakes of biotite, while the biotite gneisses are dominated by biotite, quartz, feldspar with or without hornblende (Table-2). The granites are mostly porphyritic in nature and exhibited by myrmekitic texture. Large phenocrysts of microcline are common in the granites. The mineralogy and texture of all these borehole samples more or less resemble the characteristics of the gneissic and granitic samples of Karbi Anglong district.

In the borehole samples of Lohali-1 a patch of fine grained volcanic rock is found to occur in the basement granitic rock. Petrographic study of this volcanic rock has been taken up for the first time and the study reveals that it is mainly composed of actinolite, sodic plagioclase, pyroxene with sub-schistose fabric indicating a part of metavolcanic rock.

2. LOCATION OF THE AREA

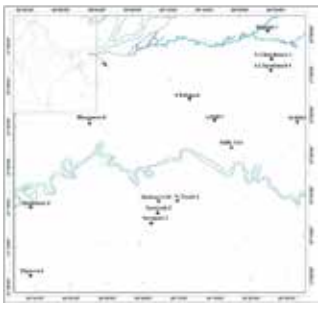

Fig 1: The location map of the boreholes in the area under study

Table 1: The Sample location with depth of the boreholes in the area under study

Sl. No	Location	Depth (m)
1	Haldibari-1 (Location- MEH)	4131.00
2	Baghjan-1 (Location TL)	3806.00
3	Chabua-4 (Location-HKZ)	3537.00
4	S.Chandmari-1 (Location-TH)	3963.00
5	Thowra-1 (Location-MEJ)	4551.00
6	Shalmari-34 (Location- DFJ)	4568.00
7	NHK-541 (Location- HPP)	4610.00
8	Sarojani-3 (Location- MET)	4870.00
9	N.Chandmari-1 (Location-TF)	3874.00
10	Lohali-1 (Location-HOB)	3875.00
11	Bhogpara-8 (Location-DIAX)	3783.00
12	Sarojani-2 (Location-DFO)	4784.00
13	NHK-544 (Location-NKF)	4149.00
14	N.Tinali-1 (Location-NKI)	------

3. BASEMENT CONFIGURATION OF UPPER ASSAM:

The Precambrian basement rock comprising Granite, Biotite granite gneiss and Hornblende biotite gneiss with pyroxene granulites doleritic veins and amphibolites are exposed in the Mikir hills of Assam and are concealed under thick cover of Cenozoic sediments in Upper Assam. These occur as tectonic high with structural downwarped country both to the NW and to the SE (Baruah et.al 1992 in Geology of Arunachal

Pradesh by Gupendra Kumar). It continues EN-Eastward as hidden basement ridge south of the Brahmaputra river upto Tinisukia and takes a northeasterly swing towards Pasighat (Fig 2). The seismic and aeromagnetic survey traces the ridge westwards from Tengakht to Majoli island in north bank of the Brahmaputra river close to Arunachal Himalaya (Fig 3). The depth of basement in and around the ridge is 3.6-4.2 km, which increases towards SE and NW (Baruah et.al.1992).



Fig 2: Bouger gravity and total intensity magnetic map of eastern part of Assam Basin in Upper Brahmaputra plain (After Baruah et.al. 1992)

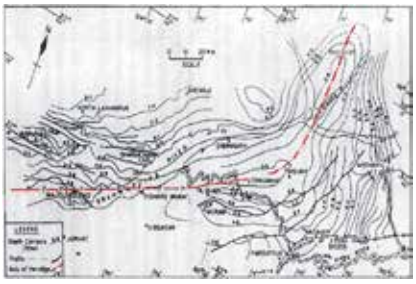

Fig 3: Regional Depth Contour map (close to basement) based on reflection seismic and aeromagnetic data showing deflection in axis of basement ridge (After Baruah et al. 1992)

4. PETROGRAPHY

Petrographic study reveals that the basement rocks of the borehole samples are Granite gneiss, Biotite-gneiss and Porphyritic Granite. The granite gneisses are predominantly composed of quartz, feldspars with or without hornblende and some flakes of biotite. The Biotite gneisses are dominated by biotite, quartz and minor amount of feldspars with or without hornblende. The granites are mostly porphyritic in nature and exhibited by myrmekitic texture. Large phenocrysts of microcline are common in the Granite.

Table 2:- Petrographic characteristics of the surface and subsurface samples

Sl.No	Slide Name	Quartz %	Hornblende %	Biotite %	Feldspar %			Name
					Plagio	Ortho	Micro	
1	Surface Sample (Sylveta area)	53.00	4.80	15.20	2.80	3.20	21.00	Biotite granite Gneiss
2	Haldibari-1	36.67	6.67	1.66	9.17	-	45.83	Granite
3	Baghjan-1	57.39	-	40.79	1.32	-	-	Biotite Gneiss
4	Chabua-4	81.00	-	7.76	9.30	-	1.94	Granite Gneiss
5	S.Chandmari-1	76.38	-	18.11	5.51	-	-	Granite Gneiss
6	Thowra-1	81.58	-	7.46	10.96	-	-	Granite
7	Shalmari-34	39.91	-	19.25	38.49	1.88	0.47	Granite Gneiss
8	NHK-541	52.50	-	7.50	3.33	-	36.67	Granite
9	Sarojani-3	32.26	-	4.03	-	-	63.71	Granite
10	N.Chandmari-1	30.39	-	12.71	2.76	-	54.14	Granite Gneiss
11	Lohali-1	44.13	-	7.82	30.17	2.79	15.09	Granite
12	Bhogpara-8	42.73	-	8.18	25.45	-	23.64	Granite Gneiss
13	Sarojani-2	63.35	-	4.97	17.39	-	14.29	Granite
14	NHK-544	47.37	-	35.53	1.32	-	15.78	Granite Gneiss
15	N.Tinali-1	13.08	-	9.35	77.57	-	-	Granite

5. PHOTOMICROGRAPHS

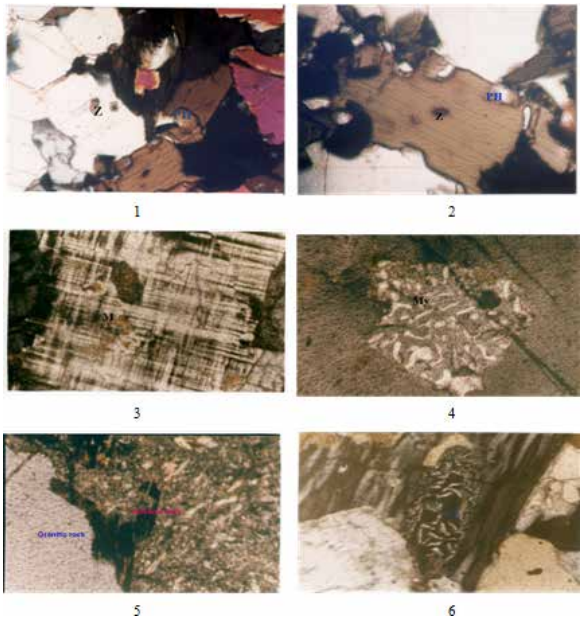

Fig 4: (1) Gneissic rock (Mikir) showing Biotite crystals with abundant inclusion (Zircon) and pleochroic halo. Magnification 10×10X, (2) Beautiful euhedral Zircon grain as inclusion and pleochroic halo observed in Biotite grain. Magnification 10×10X (Under PPL) (3) Microcline phenocryst in granite. Magnification 5×10X, (4) Myrmekitic texture. Magnification 10×10X, (5) Volcanic contact between Volcanic and Granitic rock. Magnification 10×10X, (6) Granite showing Mymerkitic texture. Magnification 5×10X

6. OCCURENCE OF VOLCANIC ROCKS IN LOHALI-1

It is interesting to note that, for the first time a patch of fine grained volcanic rock is found to occur in the basement Granitic rock of borehole Lohali-1. The petrographic characteristic of this volcanic rock reveals that it is mainly composed of sodic plagioclase, pyroxene and actinolite with sub-schistose to schistose fabric indicating a part of metavolcanic rock.

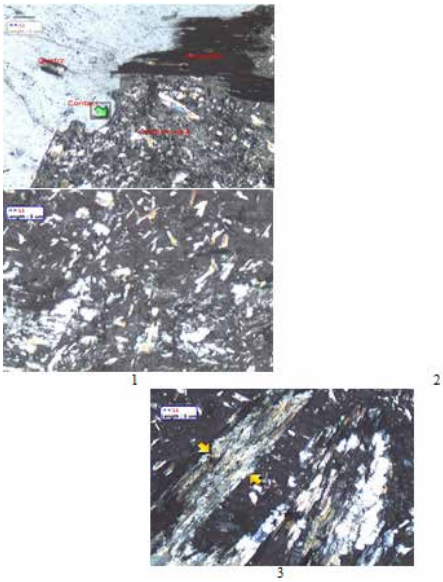

Fig 5: (1) Contact between granite and volcanic rocks, (2) Volcanic rock, (3) Actinolite schist (Metavolcanic)

7. DISCUSSION AND CONCLUSION

A total of 14 (fourteen) borehole samples of the basement complex of upper Assam basin have been analysed. The characteristics of each sample are compared with the surface sample of the Gneissic rock of Karbi-Anglong District of Assam which is supposed to be the exposed equivalent of the basement rock. The result of the studied samples

show that the rocks are mainly gneissic rocks:- Granite gneiss, Biotite gneiss and Porphyritic granites. The characteristics of most of the gneissic rocks resemble the characteristics of the surface sample of the gneissic rocks of the Assam- Meghalaya Plateau (Surface sample of Karbi-Anglong).

The granite gneisses are predominantly composed of quartz, feldspars with or without hornblende and some biotite flakes. While the biotite gneisses are essentially composed of biotite, quartz and feldspar with or without hornblende. The granites are porphyritic in nature and exhibited by Mymerkitic texture.

A very important feature in the sample of borehole –Lohali-1 is that a patch of fine-grained volcanic rock is found to occur in the granitic rock. This volcanic rock is a part of metavolcanics composed mainly of actinolite, pyroxene (feathery), sodic plagioclase with sub-schistose texture. Occurrences of metavolcanic rock are also reported from in the Assam-Meghalaya plateau, from Goalpara and Kokrajar districts of Lower Assam (GSI). However, to draw a proper conclusion on the occurrence of metavolcanic rocks in the basement rocks of Upper Assam Basin, But to arrive at a proper conclusion more investigation on subsurface samples of basement rock are required.

8. ACKNOWLEDGEMENT

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