1.1 SCOPE AND AIMS

Granulite facies metamorphic rocks form a major constituent of the Precambrian rocks of the Ajagarh hills near Agia in Goalpara district of Assam. Information on these granulites and associated rocks is rather limited and is mainly restricted to some petrographic accounts. The petrology became particularly known through the studies by Mazumdar and Chowdhary (1996) which has brought the granulite facies assemblages of the area in focus. A clear understanding of the origin and the metamorphic history of the rocks, which are essential for a correct interpretation of the geotectonic development of the area, is, however, still lacking.

The present study provides detailed petrological and chemical data on the rocks of the area. In view of the recent developments of Precambrian Geology and growths of idea on the granulite petrology (cf, Vielzeuf and Vidal, 1990) it was deemed necessary to obtain more information on the genesis of these ancient source rocks and their physicochemical conditions of metamorphism, thus amplifying our knowledge of the Ajagarh hills' granulites in particular and of Precambrian rock forming processes in general. To achieve this goal, an extensive data set on the compositions of rocks and mineral assemblages and textural relationship has to be established and evaluated applying modern concept and recent results of geochemistry and phase petrology.
1.2 LOCATION AND COMMUNICATION

The Ajagarh hills area is situated in the south of Agia in Goalpara district of Western Assam. These hills form a NE-SW trending range of hilly country with altitude varying between 350m and 500m and summit upto 563m. The investigated part of the area covers about 100 square km and lies between latitudes 26°0' and 26°5'N and longitudes 90°30' and 90°35'E. The area is included in the toposheet No.78J/12 of Survey of India on the scale of 1:50,000 (2cm to 1km) surveyed during the year 1965 - 1970.

The area is situated at a distance of 145 km from Dispur (Guwahati), the capital city of Assam. The National Highway No.37 connects the area from Guwahati and other important places of Assam. The bus services operated by the Assam State Transport Corporation and private buses form the basic means of communication network of the area. The nearest railway station which is situated in Goalpara town is only 16km away from the area.

1.3 PREVIOUS LITERATURE AND GEOCHRONOLOGY

Barring few exceptions, there is no published literature with regards the area under investigation. However, geological information on the Northeast India specifically the 'Shillong Plateau' is known from several geologists (Medlicott, 1869; Dasgupta, 1934; Pascoe, 1950; Choudhury and Narayana Rao, 1975; Mazumdar, 1976; Murthy et al., 1976a, b; Lal et al., 1978). Recently, Mazumdar (1976) and Murthy et al. (1976 a,b) has summerised stratigraphic divisions of the rocks of the Shillong Plateau. Few information on the Precambrian rocks of
Goalpara district as a whole is known from regional study by Barooah et al. (1980); Das (1996) and Bardoloi (1999) which made significant contributions towards the understanding of structure and metamorphism of Precambrian rocks in neighboring areas. Detailed structural study and deformational history of the rocks immediately north of the present area was carried out by Bardoloi et al., 1994. However, as far as the specific area of the present study is concerned, no detailed investigation was carried out barring a few rare petrographic description on the rocks of the Ajagarh hills area (Mazumdar, 1977).

Information on radiometric ages of rocks of all the regions of the Shillong Plateau is scanty. The limited isotopic data so far known for the rocks of the region are restricted to late kinematic granitic plutons of the Shillong Plateau. The Rb/Sr whole rock isochron ages of granitic plutons as obtained by various workers are 765 ± 10 m.y. from Mylliem Granite (Crawford, 1969); 647 ± 122 m.y. from the granites and pegmatites in Pancharatna, Goalpara district (Van Breeman et al., 1989). According to Ghosh et al. (1991) emplacement of granitic plutons in the region took place between 885 m.y. and 480 m.y. However, the Shillong Plateau encompasses the rock units of different ages but isotopic data on the older rocks are not known. The only available oldest age from the region so far recorded is that of the Shillong group of supracrustal rocks near Mawmaram in Khasi hills district, Meghalaya (Pb-Pb age of 1530 m.y. - 1550my, Mitra, 1998). Since the present area represents northwestern extension of the Gneissic complex, the basement rocks for the Shillong group of supracrustals, a still older age is relevant for the rocks of the Ajagarh hills area.
1.4 FIELDWORK AND METHODS OF INVESTIGATION

The field work including the mapping was carried out in three phases during 1995 - 1997.

The methodology adopted in this study includes field technique, petrographic study, sample preparation for analyses of rocks and minerals and analytical methods.

An area of 100 square km in and around the Ajagarh hills was structurally as well as lithologically mapped. The mapping was done on the scale of 1:50,000 (2cm=1km) using the Survey of India toposheet. The field investigation was carried out following the methodology of Lahee (1961).

Rock samples for different rock types were collected. Only the fresh samples, free from weathering and alterations, of relatively larger dimension were collected and sample locations were plotted in the map by the procedure of back bearing measurement using a Branton compass. During collection of samples, the contact relationship among different litho-units were carefully observed and recorded.

All the important structural features such as foliations, lineations, folds, shear zones etc. were measured, photographed and data were collected following standard methods given by Turner and Weiss (1963). A large number of oriented specimens were collected. Over four hundred rock samples were collected during five months of field work carried out and approximately two-third of these were taken for general petrography.
The petrographic study includes preparation of thin sections as well as polished blocks (for the study of opaque phases) using the Logitech grinding and polishing machine at the laboratory of Department of Geological Sciences, Gauhati University. The rock sections were studied under the Laboulux pol. 12 binocular microscope. One of the important features of petrographic study is the identification of metamorphic reactions which were based on critical textural features and solid solution chemistry of relative minerals analysed under EPMA. Further, anorthite content of plagioclase known from analytical data were compared with those determined by optical methods and in this context, it is found that An-content determined from the sections perpendicular to (001) and perpendicular to (011) show excellent results.

The whole rock analyses (only major oxide) were performed by X-ray fluorescence spectrometry (XRF) technique at the USIC, Gauhati University. The trace and REE analyses were carried out by using Inductively coupled plasma mass spectrometry (ICP-MS) technique at National Geophysical Research Institute, Hyderabad.

The criteria for selection of rock samples were: 1) fresh one free from weathering or alteration and 2) petrographic and spatial representation of the rock. A sample thus selected was cleaned thoroughly with distilled water and then dried after washing, then the sample was broken to chip size and was again cleaned with distilled water and dried. About 40 gm of sample were collected by the method of coning and quartering and crushed in a steel mortar upto about 80 mesh size. From these, about 10 gm of powdered sample were collected again by the method of
coning and quartering and were further grinded in an agate mortar. Generally, for whole rock (major oxide) analysis powdered sample of over 200 mesh size was used while a stock solution prepared from the powdered samples was utilised in trace and REE analyses by ICP-MS instrument. The procedure of preparation of stock solution is as follows:

0.25 gm of samples were taken in a 'Teflon bomb' and treated with 1 ml of aqua regia and 5 gm of hydrofluoric acid (analytical grade) which were heated at 100°C for 45 minutes. After cooling, the above mixtures were transferred into a beaker with the aid of 2.5 gm of boric acid (analytical grade) and diluted to 250ml with double distilled water which was then stored as stock solution.

Major oxide analyses were carried out using a Phillips PW 1480 AHP instrument. Samples and standards were prepared as glass disc by fusing with lithium carbonate and lithium tetraborate (1.38 gm sample, 0.433 gm lithium carbonate and 3.9 gm lithium tetraborate). Accuracy was evaluated by co-analysing Basalt-Br and other standards and in general only a small, if any, systematic error was detected.

Trace and REE analyses were carried out using a ICP-MS (VG Plasmajuad, FJ, Elemental UK) instrument. For the evaluation of accuracy standard basalt (JB-2) and others were co-analysed.

Electron microprobe analyses of the different mineral phases were performed with an automatic 3-channel wave length depressive JEOL 8600 M Super probe at the USIC, University of Roorkee. The correction programme adopted was that of Mason et al. (1968).