CHAPTER 1
INTRODUCTION

1.1. SCOPE

The Umpyrtha-Patharkhammah region in Ri-Bhoi district of Meghalaya is characterized by well defined high grade metapelitic assemblages with profusely developed monazite and xenotime which have immense potentiality in dating the geological events. As a matter of fact, the U – Th – Pb_{total} monazite and xenotime geochronology provides a powerful technique to elucidate the timing of thermal events for establishing their relationship with regional and global tectonic processes. However, thermo-chronological history of several granulite facies domains, sporadically distributed elsewhere in Meghalaya, is somewhat cloudy and it is obscure whether these high grade domains were formed within a single coherent continent or they desperately evolved crustal fragments formed at different geological periods and finally amalgamated to form the gneissic complex of the Shillong Plateau. It is well established fact that being frontal edge of Indian plate, the Shillong Plateau provides one of the best regions in the world for evaluating the assembly of the East Gondwana during the Pan-African period. In recent attempts in Pan-Gondwanic reconstruction, several workers have suggested an oblique, early Palaeozoic collision between India and the western part of Australo-Antarctica and the continuation of the Prydz Bay Pan-African suture of East Antarctica through Northeast India (Zhao et al., 1995; Boger et al., 2001; Fitzsimons 2003 and references therein; Chatterjee et al., 2007; Kelsey et al., 2008). Chatterjee et al., (2007) proposed that a Pan-African final amalgamation of the Indian plate with the Australo-Antarctic plate and a northward extension of the Prydz Bay suture through the Shillong plateau, with the western boundary of the suture possibly located between the Garo-Goalpara Hills and Sonapahar areas in the western part of the present study area. However, the lack of thermo-chronological data of large expanses of high grade rocks from the central part of the Shillong Plateau has limited our understanding of the high grade rocks in this region. In this context, thermal and chronological information of the high grade rocks in the uniquely positioned area around Umpyrtha – Patharkhammah located in the central part of the Shillong Plateau holds an important role in global scale reconstruction of the Gondwanaland.
1.2. LOCATION AND COMMUNICATION

The area of investigation, Umpyrtha-Patharkhammah, included in Toposheet No. 78 O/9 of Survey of India, is located between latitudes $25^0 49' 30'' - 25^0 57' 00''$ N and longitudes $91^0 33' 00'' - 91^0 42' 00''$ E in the district of Ri- Bhoi, Meghalaya, NE India. Geologically, Umpyrtha-Patharkhammah forms a major part of the central part of the Shillong Plateau and is important with respect to the problem stated above since the Shillong Plateau represents the extreme northeastern edge of the Indian plate.

The area is connected to Dispur (Guwahati), the capital city of Assam via Rani or Mirza. The area is situated at the distance of about 80 km from Guwahati. The area can be accessed from Shillong, the capital city of Meghalaya via Mairang by 110 km long metalled road or also via Nongpoh-Umling by about 112 km long metalled road. Kamakhya is the nearest railway station of North East Frontier Railway along broad gauge railway line. The nearest airfield is Loko Priyo Gopinath Bordoloi international airport, Guwahati. Private bus services and hired taxi from Guwahati or Shillong comprise the basic means of communication.

1.3. PHYSIOGRAPHY AND DRAINAGE

Topographically the area is a thickly forest hilly terrain. The geomorphic units in the area include residual and denudational hills with narrow valleys.

The maximum and minimum elevation of the study area is about 450 m and 320m respectively above the mean sea level. The trend of the hill ranges is NE-SW direction which is also the general trend of the regional foliation. The exposures of rock types are scanty. The outcrops are confined along the eroded slope of the hills, road and river cutting, and quarries. Thick soil cover and dense forest-coverage hinder detailed geological, structural mapping in the study area.

The area is drained mainly by Umpyrtha stream which flows east-northeast wards and joins the Umshaid nala (Barigang nala) at Umpyrtha village. The latter flows in a southerly direction before draining into the Khri river. The overall drainage pattern of waterways is dendritic.
1.4. AIM AND OBJECTIVES

The aim of the present research is to obtain an understanding of metamorphic evolution and chronology of high-grade metapelites in the Umpyrtha – Patharkhammah region to know their involvement in the final amalgamation of East Gondwanaland during Pan-African time. For the purpose the following objectives are undertaken.

1. Geological mapping, sampling and study of mineral paragenesis, mineralogical and textural relations to identify mineral reactions for reconstruction of petrographic P-T path of the rocks. In addition, the timing of mineral-growth in relation to deformation and metamorphic events is established.

2. Study of mineral compositions on the basis of EPMA data and quantitative estimation of metamorphic variables, pressure and temperature conditions of metamorphism and construction of P-T path on the basis of geothermobarometry and petrogenetic grid consideration.

3. EPMA monazite and xenotime dating in the metapelites of the study area.

4. Interpretation to know the genesis of the high grade rocks of the Shillong Plateau on the basis of integrated studies and to compare and contrast the results of this study with other similar high-grade metamorphic terrains of comparable age for the better understanding of the global scale reconstruction of the Gondwanaland.

1.5. METHOD OF STUDY

An area of ~ 200 square km around Umpyrtha - Patharkhammah (latitude 25° 56' 00" - 25° 50' 31" N and longitude 91° 34' 00" - 91° 40' 40" E) in Ri - Bhoi district of Meghalaya was geologically mapped on a 3.15 cm to 1 km (2 inches to 1 mile) scale. More than 200 rock samples were collected during four months of field work carried out in six field sessions and approximately two-third of these were studied for general petrography. About one hundred and fifty (150) rock samples were selected for detailed petrographic studies. Finally, after a close petrographic details and field
association one hundred and nineteen (119) minerals belonging to different samples were analyzed by electron microprobe (EPMA).

Electron probe microanalyses of different mineral phases were performed by using a Cameca SX100 Electron Probe Micro Analyzer equipped with four wavelength dispersive spectrometers at the Department of Geology and Geophysics, Indian Institute of Technology, Kharagpur, West Bengal.

The whole rock analyses of metapelitic samples were performed by X-ray fluorescence spectrometry (XRF) technique at the USIC in Wadia Institute of Himalayan Geology, Dehradun. Major oxide analyses were carried out by using a X-Ray Fluorescence Sequential Spectrometer (XRF-Siemens SRS-3000). The sample used for XRF analysis was cleaned thoroughly with distilled water and then dried, broken to chip size and was again cleaned with distilled water, dried and finally grinded in a pulverizer machine up to 200 - mesh size.