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# Precambrian Rocks of North-East India

B MAIBAM*
*Department of Earth Sciences, Manipur University, Canchipur, Imphal 795 003, India*

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In the northeast India, Precambrian rocks are exposed in Arunachal Pradesh, Assam and Meghalaya. Precambrian geology is highly complicated and cannot be resolved by reconnaissance-type studies and correlation is based mainly on lithologic similarities. Detailed field and laboratory studies are essential for the understanding of Precambrian chronology and such studies must include careful evaluation of petrogenetic processes of sedimentation, diagenesis, metamorphism and granite-formation. Most of the studies in northeast India Precambrian rocks, are based on reconnaissance-type studies. Petrological-geochemical and geochronological studies have been carried out to correlate with global supercontinent.

**Keywords: Precambrian; Gondwana; Geochronology; Zircon**

## Assam and Meghalaya

Kumar *et al*. (2017a) have recognized major contribution of the Columbia and Gondwana assembly- and growth-related felsic magmatism (1778-1617 Ma granite gneisses and 535–506 Ma granites) in the evolution of the Meghalaya Plateau and the Karbi Anglong areas. U–Pb SHRIMP analysed zircons in granitoids (535-506 Ma) contain older inherited zircon cores (2566.4+26.9, 1758.1+54.3, 1617.1+14 Ma), indicating significant role for recycled ancient crust in the generation of granitoids of the Meghalaya Plateau (Kumar *et al*., 2017a). Based on the mineral and whole-rock geochemistry and U–Pb SHRIMP zircon geochronology Kumar *et al*. (2017b) showed that the Meghalaya Plateau and Mikir Hills experienced major felsic magmatic episodes at ~1800Ma, ~1600 Ma, ~1400 Ma, and ~500 Ma with recycling of Neoarchaean crust (2.55 Ga), and later contributions from Paleo-Mesoproterozoic granite gneiss sources (1.76 and 1.62 Ga). They have also suggested a probable Permo-Triassic thermal imprint (260 Ma) inferred from lower intercept age of the Rongjeng granite gneiss.

Majumdar and Dutta (2016) reported occurrence of A-type granite plutons in the Dizo Valley of the Karbi Anglong area. On the basis of U–Pb zircon dating the Kathalguri A-type granites have been dated ~515 Ma, and Lu–Hf isotopic data of the zircons suggest that the granite precursors were formed by partial melting of 2250-2670 Ma old crust of magmatic origin.

On the basis of xenotime dating of high grade (6.5 kbar and 750°C) metapelitic rocks from the parts of Meghalaya, Borah *et al*. (2019) have reported tectonothermal events at 1150, 930, 820 and 500 Ma whereas monazite records only the 500 Ma event. The authors suggested that among the two accessory minerals, xenotime chemical dating is more suitable for the application in complexly evolved metamorphic terranes.

Kumar *et al*. (2017b) studied the microgranular enclaves and the felsic host South Khasi Hills Granite. Elemental variations suggest a hybrid origin for the microgranular enclaves in the South Khasi Granite, formed by linear to chaotic mixing of mafic and felsic magmas, whereas synchronous fractional differentiation may also have controlled the geochemical variations of the mafic enclaves.

Sadiq *et al*. (2017) suggested evidence of magma hybridization in mafic magmatic enclaves

**Author for Correspondence: E-mail: bmaibam@yahoo.com*

(MMEs) in Nongpoh granitoids. The authors have documented mafic injections during different stages of crystallization of Nongpoh granitoids. The early injections resulted MMEs whereas the later injections led to the syn-plutonic dykes. The later intrusive syn-plutonic dykes supplied supplementary heat required for local re-melting of the host granite and crustal reworking process. MME are formed due to hybridized mafic injections during the Cambrian and its age of crystallization has been dated to 501 ± 5 Ma by monazite dating and is similar to the Pan-African plutonic and tectonothermal events.

**Arunachal Himalayas**

Kumar (1997) has identified nine super-sequences on the basis of major geological episodes. Out of which, first three are restricted during Proterozoic or Precambrian. The sequences are (a) Se la Group assigned to Early Proterozoic (b) Bomdila Group belonging to Middle to late Proterozoic age (c) Dirang and Lum La Formation probably of Mesoproterozoic age. Systematic study of the Precambrian rocks of the Arunachal Pradesh are picking up.

Pathak and Kumar (2019) have carried out geochemical and geochronological study of felsic magmatic rocks of the Bomdila Granite gneiss. The authors suggested that parental melt was most likely to have been generated by dehydration melting of metasedimentary sources at middle-upper crustal depths in syn- to post-collisional tectonic settings. On the basis of U–Pb zircon dating, they have reported weighted mean crystallisation age of 1752 ± 23 Ma and suggested involvement of ancient continental crust inferred from the negative εHf(t) values (–1.67 to –7.99) and three-stage Hf-model ages (2818, 2586-2424 and 2393-2250 Ma) in the generation of the Bomdila Granite Gneiss. The authors suggested that the reworked ancient crustal components would have once been a part of the northern Indian lithosphere.

Goswami *et al*. (2009) have reconstructed inverted metamorphic sequence in the Lesser and Greater Himalayan Sequences of the western Arunachal Pradesh. Five metamorphic zones (garnet, kyanite, kyanite migmatite, kyanite-sillimanite migmatite to K-feldspar-kyanite-sillimanite migmatites) are sequentially identified in the metamorphosed low-alumina pelites of Dirang and Se La Group. The authors have estimated near isobaric metamorphism (~8 kbar) and metamorphic temperature ranging between 550 to >700°C. Based on petrochronological study, Clarke *et al*. (2016) have documented the metamorphic grade and age relationship of the area and suggested that the Indo-Asian collision is culminated at Oligo-Miocene. The authors reported detrital age spectra c. 2500, 1750-1500, 1200 and 1000 Ma.

Bikramaditya *et al*. (2019) have carried out geochronological and geochemical study of the metagranitoids of the Subansiri region. They have reported U–Pb zircon age ranging between 486 to 516 Ma with negative εHf(t) values ranging from –1.4 to –12.7. They have suggested a major crustal growth during Proterozic which caused partial melting of older metasedimentary rocks.

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