

Geology of Arunachal Pradesh

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Introduction

Location and Extent

Arunachal Pradesh – the land of the dawn-lit mountains, is the northeasternmost State of India lying between latitudes $26^{\circ}40'$ and $29^{\circ}25'$ N and longitudes $91^{\circ}35'$ and $97^{\circ}25'$ E, and occupies an area of $83,580 \text{ km}^2$ of Indian territory. Formerly, it formed the mountainous part of the Assam State known as the North Eastern Frontier Agency (NEFA), which due to its location, difficult terrain with dense impenetrable forests, bad climate, backwardness and hostile nature of inhabitants, far away from civilisation, was administered by the Ministry of Home Affairs with Governor of Assam acting as Agent to the President of India. Later, it was made a Union Territory with capital at Itanagar – a newly developed township. It attained statehood on February 20, 1987. The Himalayan Kingdom – Bhutan, lies to its west, the Tibetan Plateau and the Yunnan Province of China form its northern and northeastern limits and southeastern boundary is with Myanmar (Burma). The international boundary with Tibet (China), known as the MacMahan Line, was marked on map in a convention – the Simla Convention, 1914, between the concerned countries. The upper part of the Brahmaputra Plain of Assam separates the northern part of the State forming the Himalayan ranges from the southeastern part in the Arakan ranges, the latter continuing into the Nagaland State (Fig.1).

Early History

Assam from which the State was carved out was earlier the northeastern most province which came under British rule after the treaty

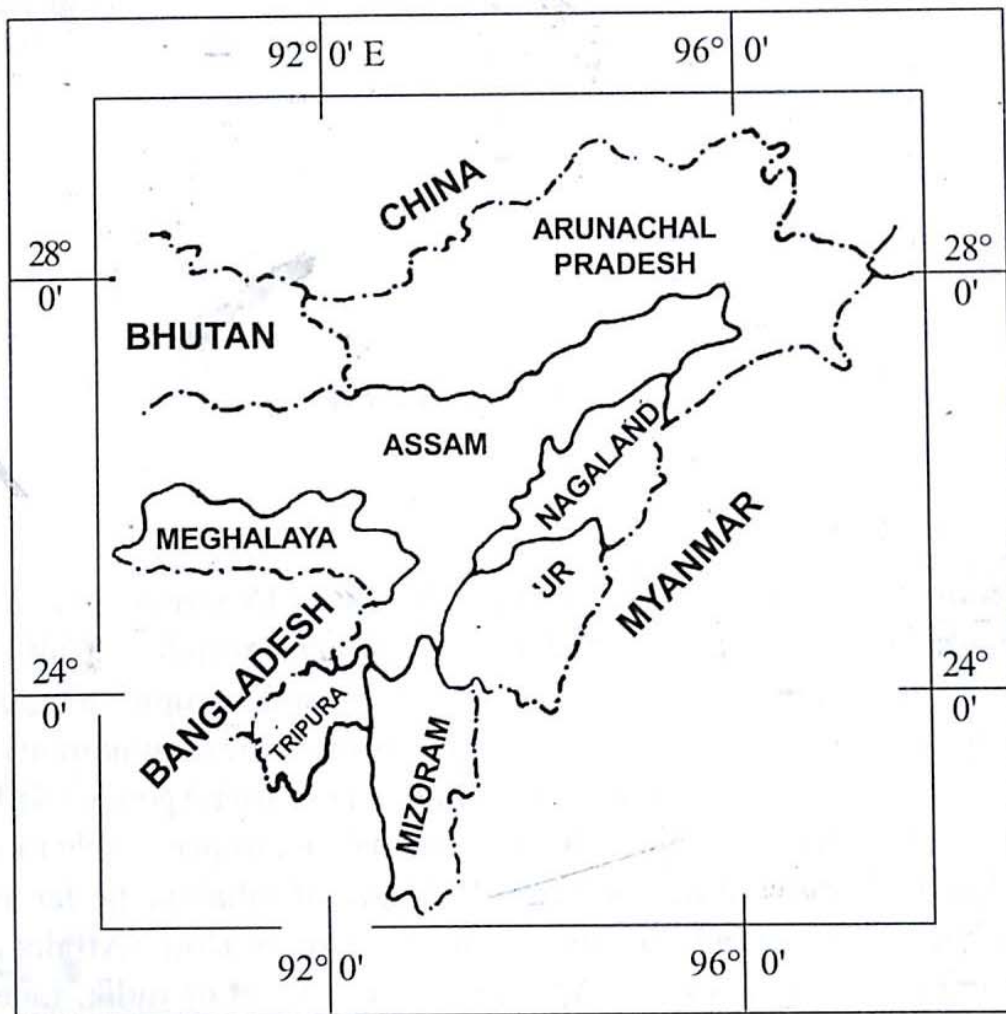


Fig.1.1. Location of Arunachal Pradesh

of Yandabo in 1824 with the Burmese (Myanmar) Government. Earlier, Assam was an independent State ruled by Ahom King who crossed the Patkoi ranges from Burma and settled during early part of 13th Century. Before Ahoms, the country was known as Kamarupa which included present day Bengal and Bangladesh. The Chinese traveller Hiuen Tsang visited Kamarupa in 640 A.D. In 18th Century, the Ahom Kingdom was in a state of total anarchy and the ruling prince sought the help of Britishers from Calcutta in 1792 who restored peace. After another period of crisis in 1817, the Burmese entered Assam. The ruling prince fled to Bengal and Britishers, who were once again approached for help, fought several battles and defeated the Burmese. By a treaty – the Yandabo Treaty in 1824, the Burmese withdrew from Assam, and by 1842 the whole of Assam came under British rule. Due to the hostile nature of the tribal people, who attacked and killed several

explorers and political officers, the Government of India introduced an inner-line by the Bengal East Frontier Regulation I of 1873 and prohibited entry without a pass. In 1874, a separate province of Assam was created with Shillong as its capital under the administrative control of a Chief Commissioner. The Government also introduced the Frontier Tract Regulation in 1880 "to any tract inhabited or frequented by barbarous or semi-civilised tribes adjoining or within the border of any district included within the territories under the administration of the Chief Commissioner of Assam" (Das, 1970), and appointed political officers. However, Assam was merged with eastern districts of Bengal in 1905 and known as Eastern Bengal and Assam with headquarters at Dacca. This arrangement lasted till 1924 when Assam was made a separate province.

Three Frontier Tracts were created in September 1914, viz., i) the Central and Eastern Sections of North-East Frontier Tracts covering the Abors, Miris and Mishmis, ii) the western section of North-East Frontier Tract including Monpas, Akas, Daflas and parts of Abor and Miri tracts, and iii) the Lakhimpur Frontier Tract. By another notification of March, 1919, the first and second Frontier Tracts were renamed as the Sadiya and the Balipara Frontier Tracts, respectively. The Government of India Act, 1935, excluded or partly excluded these hill-tracts from Assam to be governed by the Governor under the general control of the Governor General till such time as the areas were ready to be merged (Section 92 of the Act, 1935). This administrative arrangement continued till independence in 1947.

Under the Constitution of India which came into effect from 26, January 1950, more detailed provisions for administration of the Frontier Tracts known as the North East Frontier Agency were made under the Sixth Schedule.

Chief Tribes

Arunachal Pradesh is inhabited by as many as 52 major tribes and subtribes having a population of 9,36,342 according to census of 1991. The chief tribes are the Monpas in the Tawang area, the Akas in the Tenga and Bichom valleys, the Daflas between Kameng and Subansiri rivers, the Miris in the upper reaches of Subansiri river northeast of

Dafla, the Abors between Subansiri and Dibong rivers and the Mishmis in the Dibang valley upto border with Myanmar. Accordingly, the region has been divided into several segments such as the Aka hills, the Miri hills, the Abor hills etc.

The tribes have mongoloid features, patriarchal society with rich heritage of art and craft. The people worship the Sun God, though the influence of Buddhism in areas close to Bhutan and Tibet, especially in Tawang area which has a big monastery (Fig.1.2), and Christianity in

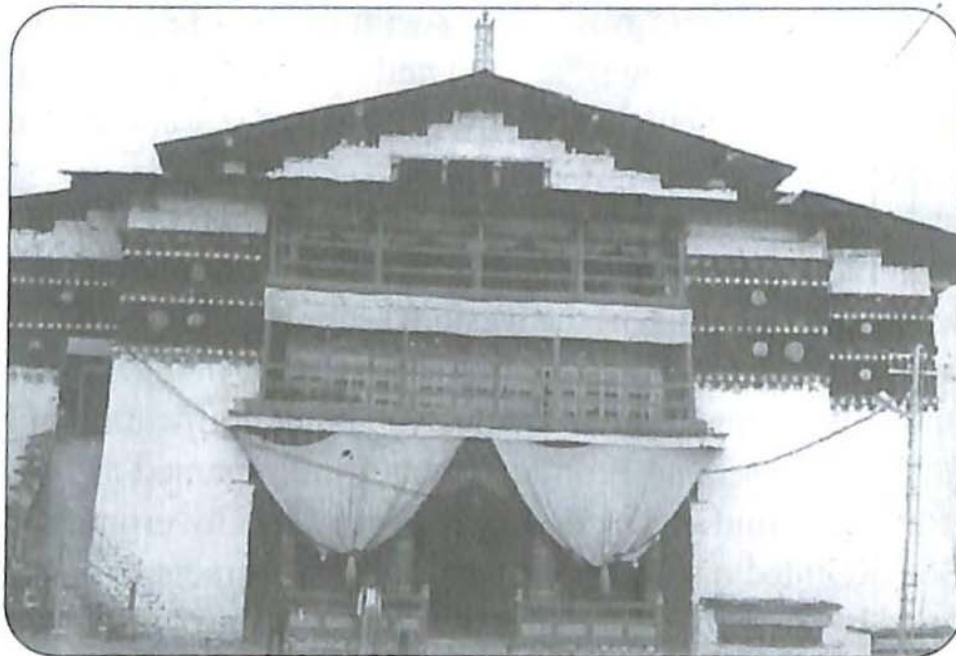


Fig.1.2. Buddhist Monastery Tawang

Pasighat area, is prevalent. The tribes live in huts made up of bamboos with thatching by palm leaves (Fig.1.3). The living rooms are made 2-3 m above ground level to save themselves from flooding due to heavy rains. The ground-floor is generally used for keeping cattle. There are still some cave-dwellers in the northeastern part. They practice *Jhum* (shifting) cultivation, a legacy of Neolithic culture but are now slowly adopting to settled cultivation. Rice is the main crop. Maize, millet, wheat, pulses, sugarcane and oil-seeds are also grown. Horticulture is also picking up where fruits such as pineapple, oranges and lemon, apple, walnut etc. are grown. Poultry farming is also picking up. The State animal is Mithun – a breed of buffalo, and its possession is symbol of prosperity, the greater the number of Mithun, the richer the person who

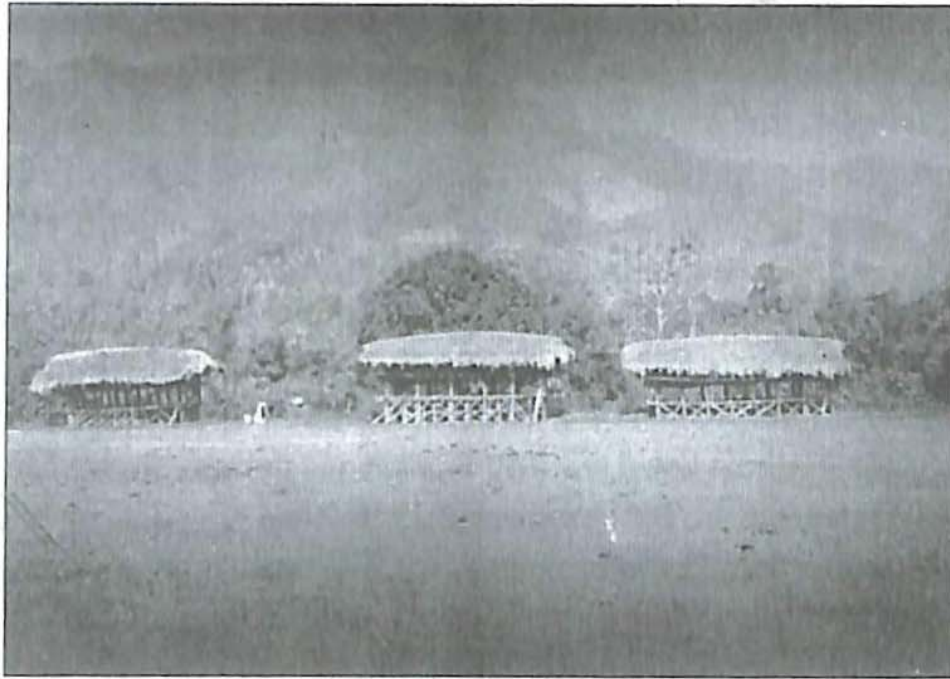


Fig.1.3. Bamboo huts with palm leaves thatching (Photo: S.K. Sharma)

owns them. The buffalo is not used for milching but for meat on special occasions.

Administrative Divisions

Arunachal Pradesh has been divided into thirteen districts, namely, Tawang, West Kameng, East Kameng, Papum Pare, Lower Subansiri, Upper Subansiri, East Siang, Upper East Siang, West Siang, Dibang, Lohit, Changlang, Assam, Nagaland, Tirap, and Myanmar.



Fig.1.4. Districts and their administrative boundaries in Arunachal Pradesh (Administrative boundaries of recently created Papum Pare and Upper East Siang districts not shown/ or are approximate.

Valley, Lohit, Changlang and Tirap (Fig.1.4). Excepting Changlang, all the districts are named after rivers of that name.

Climate

The climate, though warm and humid subtropical, varies considerably with altitude. It is hot and humid in Brahmaputra Plain, Sub-Himalaya and Naga-Patkoi ranges, cooler in Lesser Himalaya and Alpine type in Higher and Tethyan Himalayan zones. It has three seasons. The summer is comparatively short lived starting from April and ending in May with the onset of monsoon. Temperature may rise up to 38°C in the Sub-Himalayan zone. Monsoon remains active till September, June and July being the wettest months. Being in the zone of heaviest rainfall, the average rainfall is more than 3,000 mm. The winters are cold and damp. The average temperature varies between 0° and 5°C in the Brahmaputra Plain and the Sub-Himalaya while in higher reaches above 2,000 m sea level, it drops below freezing point with occasional mild to heavy snowfall.

Flora

On the basis of interpretation of the satellite imageries, a total area of 68,661 km² (82.15%) is estimated to be under forest cover (Anon., 1993). These forests are broadly classified into: tropical, sub-tropical, conifers, temperate and alpine-type. The tropical forests are restricted to foothills bordering the Brahmaputra Valley up to an elevation of 1000 m. There is some floral differentiation on the North and South Bank forests (Puri et al. 1995). In Tirap-Changlang and Lohit districts, it is dominated by huge trees of Hallong (*Dipterocarpus macrocarpus*), *Shorea asamica* (Mekai), *Terminalia myriocarpa* (Hallock), *Mesua ferrea* (Nahor) which are intermixed with *Talauma hodgsonii*, *Dysoxylum hamiltoni*, *Ailanthus grandis*, *Altingia excelsa*, *Tetrameles nudiflora*. The forests along the North Bank (Sub-Himalayan part) occur in discontinuous patches and are characterised by *Canarium - Syzygium - Quercus*, *Altingia - Mesua - Syzygium - Echinocarpus* and *Mesua - Altingia - Engelhardtia* association. Apart from these, large woody climbers such as *Bauhinia*, *Accacia*, *Derria*, *Unona*, *Toddalia* and gymnosperm *Gnetum ula* intermixed with

canes are frequent spreading over trees. Palms are represented by *Caryota urens* (fish tail palm) and species of *Licuala*, *Arenga*, *Pinanga* and *Didymosperma*. *Bambusa* and *Dendrocalamus* are large bamboo species which form dense clusters. Wild banana - *Musa* spp., grows abundantly in valleys. Small trees commonly include species of *Saurauia*, *Antidesma*, *Pavetta* and *Maesa*. *Bischofia* and other species with large planked-buttresses also grow along with herbaceous species on the forest floor.

The sub-tropical and conifer forests occupy altitudes of 1000 to 1800 m and are mostly mixed type and include evergreen species of oak, pines, acers, laurels, magnolias, *Ficus*, *Prunus*, *Engelhardtia* etc. *Rhododendron arboreum*, becomes conspicuous during flowering season. Some palms, wild banana species, large ferns, orchids, balsams, begonias etc. form undergrowth. A variety of epiphytic orchids, aroids, ferns,



Fig.1.5. Variety of epiphytic orchids, aroids, ferns, mosses and lichens.

mosses and lichens are seen growing over large trees (Fig.1.5). Temperate forests occur between 1800 to 3000 m altitude and include conifers and many species of *Quercus*, *Michelia*, *Magnolia*, *Exbucklandia*, *Populus*, *Rhododendron*, *Alnus* etc. Alpine forests occur between 3000 and 4000 m altitude which in lower altitudes, includes conifers and

Rhododendrom spp. Dwarf and twiggy species of *Rhododendron*, *Saxifraga*, *cotoneaster*, *Festuca* are seen at higher altitudes.

Fauna

Arunachal Pradesh is rich in faunal components as well, which varies with different forest types (Pal, 1993). Tropical evergreen forests because of their luxuriant growth are rich in faunal elements like elephants (*Elephas maximus*), sambar, barking deer, gaur, hoolock gibbon (*Hylobates hoolock*), tiger (*Panthera tigris*), leopard (*Panthera pardus*), jackal and many birds like spotted babbler, red breasted flycatcher, bush warbler, hill partridge and reptiles which include python, king cobra, blind snake, tree snake etc. Leeches and insects are common.

In subtropical broad-leaf and pine forests the common animals are capped and common langurs, giant flying squirrel, leopard, Himalayan black bear (*Scelenarctos thibetanus*), panda (*Ailurus fulgens*), deer, rat squirrel, porcupine, rats, wolf, many birds like peacock pheasant, grey jungle fowl, hill partridge, spotted dove, wreathed hornbill, ashy wool pigeon, jungle crow, grey headed myna, etc. and reptiles like rock python, black krait, blotched pit viper etc. Large number of insects are quite common.

Temperate forests harbour snow leopard (*Uncia unica*), musk deer (*Moschus chrysogaster*), serow (*Naemorhaedus sumatraensis*), goral, yak, Himalayan marmot etc., many birds like snow pigeon, bartailed cuckoo dove, hoopoe, black bulbul and Sikkim black tit.

Communication

Arunchal Pradesh does not have railways, but the broad guage railway line of the Northeast Frontier Railway along the north bank of the Brahmaputra, from Rangia to Murkong Selek in Assam, meets the requirements of the State. Itanagar can be approached from Harmati railway station which is about 32 km away. The nearest Airport is at North Lahimpur in Assam which is about 45 km from Itanagar. There are small airstrips at Along and Tezu which are suitable for small aircraft.

Road and foot-tracks are the main lines of communication. All-



Fig1.6. Cane-suspension bridge (Photo: S.K. Sharma)

weather metalled roads passing through Assam connect Itanagar with different parts of the State. In the absence of permanent bridges over Siang, Dibang and Lohit rivers, the northeastern part of the State remains practically cut-off during monsoon due to suspension of ferry services. Foot-tracks with cane-suspension bridges (Fig.1.6) are the only means of communication with interior villages.

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