
CHAPTER— I

I N T R O D U C T I O N

In the early Palaeozoic major geological activities occurred in India. They represent the disposition of Vindhyan rock and there uplift into land. These new changes occurred a part of stratigraphical history of India. Like India new changes also took place all over the world in the Upper Carboniferous Period. These changes resulted in redistribution of the land and sea. They were responsible for the building of mountains. Hence a great Southern Continent was formed having series of land masses. These land masses show close resemblance of floral distribution on the land. This Southern Continent is named as Gondwana land. The ^{name} Gondwana was derived from the brave Mediveal tribes whose kingdom of gonds was spread over the part of Madhya Pradesh, Maharashtra and Andhra Pradesh.

The term Gondwana, initially used by H.B. Medlicott in an unpublished report (1872). It was later on published by Feistmantel (1876) with the rank of a "System". According to Fox (1931) a time span from Middle Carboniferous to Upper Jurassic forms the Gondwana "System". Later on the time span was changed to Upper Carboniferous to Lower Cretaceous in the Lexique internationale. Sastry et al. (1977) have suggested early Permian to Early Cretaceous in stratigraphical Lexicon of Gondwana formation of India.

This Southern continent is named as Gondwana Land. It

includes India, Australia, South Africa, South America, Antarctica and Madagascar island. The Gondwana land shows a characteristic climate and type of rock distribution as well as fauna and flora.

The Gondwana period resumed with a temperate climate where deposits of glacial boulder-beds were formed. The major part of the Gondwana deposits represent series of rock deposits having plant fossils. The deposits formed in the shallow basins and started sinking every time due to these activities deposition of coarse sand stones and then forming fine shales took place. Finally their activities resulted into coal beds. The plant fossils preserved in Gondwana rocks are found in a series of basins. They are represented in Peninsular India in the form of Warda-Godavari valley, Mahanadi valley, Krishna-Godavari valley and others. The extra Peninsular deposits are found in Assam, Bhutan, Kashmir and Nepal.

Recently, Venkatachala and Maheshwari (1991) suggested that continuous sequence of sediments laid down in Peninsular India which include a glacial unit near the base and a red-bed facies at the top. Along the East Coast series of detached out crops are present in Orissa, Andhra Pradesh and Tamil Nadu. These are mostly Mesozoic deposits and called as East-Coast Gondwana. These beds are marginal marine deposits and have special features.

The Gondwana system in India is classified in different ways

regarding the age of different stratas there are different views proposed by scientists. According ^{to} first view the Gondwana system consists of two divisions, they are named as - (1) Lower Gondwana, (2) Upper Gondwana. This view is termed as 'Bipartite, classification' and supported by Medlicott and Blanford (1879), Oldham (1893) and Cotter (1917).

The second view represents three divisions namely (1) Lower Gondwana, (2) Middle Gondwana, and (3) Upper Gondwana. It is called as 'Tripartite classification'. This view is suggested by Feistmantel (1882), Vredenburg (1910) and Wadia (1957). According to Surange and Lele (1974) distinct floras developed in the different Gondwana periods. The Lower Gondwana represents a Glossopteris flora. The Upper Gondwana periods shows a Ptilophyllum flora having several elements. According to Fox (1931) this pattern needs some modification. Krishnan (1960) also supported the two-fold division which was accepted as an official system by geological survey of India. The two-fold system is represented by various workers in the following patterns.

According to Fox (1931) the two-fold system includes the following divisions.

Classification of Fox (1931) :

Upper Gondwana	Jabalpur Series	Umia Stage	
		Jabalpur Stage	Lower Cretaceous
		Chaugon Stage	
	Parsora Series	Kota Stage	
		Rajmahal Stage	Jurassic
		Parsora Stage	
	Mahadeva Series	Maleri Stage	Triassic
		Pachmarhi Stage	
	Lower Gondwana	Panchet Series	Hirapur Stage
Maitur Stage			
(Mangli beds)			
Raniganj Series		Kamthi stage	
		Raniganj Stage	
Barren Measures		Mahadeva Stage	
		Iron Stone Shales	Damuda
		Kulti Stage	
Barakar Series		Barakacr Stage	
		Karharbari Stage	Permian
		Umaria marine beds	
Talchir Series		Rikba plant Stage	Upper
		Talchir needle shales	Carboniferous
		Glacial Boulder beds	

Fox (1931) suggested that the Upper Gondwana flora developed after the formation of Glossopteris flora and there was no significant

gap between these two floras. Hughes (1881, 1884) collected several plant fossils from South Rewa basin in Madhya Pradesh. The localities belong to Upper Triassic horizon. Feistmantel (1882) found a Lower Gondwana element like Glossopteris in this region. Hence these formations were termed as Supra-Barakars. Feistmantel (1882) studied the Parsora beds in the South Rewa basin and found that these beds show distinct lithological and palaeobotanical evidences. He observed that the flora found in the Parsora bed represents combination of Lower Gondwana and Upper Gondwana elements. Therefore, the Parsora beds were named as 'Transitional beds'.

Feistmantel (1882) suggested that the Parsora beds represents distinct lithological and Palaeontological features. These beds having a mixed flora of Upper Gondwana and Lower Gondwana elements forming a new division called as Middle Gondwana. Therefore, the tripartite classifications of Gondwana include following divisions as suggested by Feistmantel.

Classification of Feistmantel (1882)

Upper Gondwana	Jabalpur Kota Rajmahal	Jurassic
Middle Gondwana	Parsora Panchet Damuda	Triassic
Lower Gondwana	Karharbari Talchir Talchir boulder beds	Permo Carboniferous

Later on the three-fold system was supported by Vrendenburg (1910) and followed the Feistmantel's three-fold division with minor changes. He included Damudas into the Lower Gondwana. According to Vrendenburg the three fold classification includes following divisions. Classification of Vrendenburg (1910):

		Tirupatty	
		Chikiala	
Upper		Veemavaram	Jurassic
Gondwana		Jabalpur	
		Kota	
		Rajmahal	
		Maleri	
Middle	Kamti	Kamti	Triassic
Gondwana		Panchet	
		Raniganj	
Lower	Damuda	Iron stone shales	
Gondwana		Barakar	Permian
	Talchir	Karharbari	
		Boulder beds	

Eminent geologist Wadia (1957) agreed with a three-fold division of Gondwana having the Panchet, the Mahadeva and the Parsora in the Middle Gondwana. He suggested that Middle Gondwana represents a distinct divisions due to its characteristic lithology,

climate and fauna. It shows some unconformity below the Panchets.

The three-fold division attracted many workers. Saksena (1952) also supported it and studied the plant fossils from Pali and Parsora beds in South Rewa Gondwana basin and observed that-

1. Parsora beds did contain 'Glossopteris flora' and its elements.
2. It shows a mixture of Glossopteris and Dicroidium.
3. There is continuity between Pali and Parsora beds.

These newly discovered facts were further supported by subsequent contribution of Lele, who continuously explored the South Rewa Gondwana basin and published several accounts in (1955, 1961a, 1962.)

Lele was basically a geologist but made large Palaeobotanical contributions on the Middle Gondwana flora of India. He strongly advocated that a Gondwana system in India is made up of three divisions viz. Lower, Middle and Upper Gondwana. Each division is represented by a characteristic element viz. Gangamopteris, Dicroidium and Ptilophyllum respectively. These elements are called as index fossils. Most of the workers in India recognise Glossopteris as the index fossils of the Lower Gondwana. But Lele thinks that Gangamopteris is representative of the Lower Gondwana because he considered Glossopteris as a 'Hold-over' fossil of the Lower Gondwana as it lingers in the Triassic Dicroidium

flora. On the other hand, Gangamopteris is much dominant in the lower part of the Lower Gondwana and became extinct at the end of Lower Gondwana. This observation is specific view of Lele's findings based on his individual work and different Palaeobotanical evidence and other geological findings. He putforth a new scheme of three-fold classification :

Classificatin of Lele

	Umia	
Upper	Jabalpur	Jurassic to
Gondwana	Kota	Lower Cretaceous
	Rajmahal	
	Mahadeva	
Middle	Parsora	Rhaetic
Gondwana	Maleri	Triassic
	Panchet	
	Raniganj	
	Barren measures	
Lower	Baraker	Permocarbaniferous
Gondwana	Karharbari	and Permian
	Talchir and	
	Glacials	

The scheme suggested by Lele was further suggested by following Palaeobotanists Bose (1966a, 1966b), ^{and} Maheshwari (1966b).

While Lele considers Gangamopteris as the index fossil of the Lower Gondwana; Surange suggested Glossopteris as the index fossil. Because Surange observed that Gangamopteris is absent in Raniganj Stage which marks the end of Lower Gondwana. He further suggested that in the two-fold division of Gondwana system the line of demarkation between Lower and Upper is represented by the Panchet Series. The Lower part is characterised by Glossopteris flora and Upper represents the Ptilophyllum flora. Theree' appears the third distinct flora between the Glossopteris and Ptilophyllum which is characterised by Dicroidium flora. It also represents the Middle Gondwana division in the three-fold system and considered as the Middle Gondwana flora. Recently collected Palaeobotanical data strongly supported the three fold division of the Gondwana system. The observations are based on the contribution of several workers like Feistmantel, Vrendenburg, Saksena, Lele and Surange. Recently Bose (1966a) suggested that a Gondwana period should be divided into series and stages instead of divisions like Lower, Middle and Upper. This will be more useful for the reference of smaller sub-divisions which can be directly related to the standard geological time scale.

Recent Paleobotanical discussion on the Gondwana and its classification have brought many new suggestions. According to Bose (1966 a) the geologist should first form the mapping of the areas

and then the Palaeobotanist should fix their floristic findings. This will help to resolve several problems in Gondwana stratigraphy. For this purpose Geologist and Palaeobotanists should have a combined contributions and such results will be more useful in solving the problems.
