

ENDEMIC MIOSPORE GENERA IN THE LOWER GONDWANA COUNTRIES

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ABSTRACT

The megafossil and miospore assemblages in the different countries of the Lower Gondwana are strikingly similar to each other. Yet all the Gondwana countries, so far palynologically known, have few endemic miospore genera. Some of these genera reported from Australia, Brazil, India, Pakistan, Uruguay and Zaïre have been described. Most of these genera belong to cryptogams and several to gymnosperms. The reason for the endemic nature of these genera has also been discussed.

Key-words — Endemic miospores, Cryptogams, Gymnosperms, Lower Gondwana.

सारांश

अधर गोंडवाना देशों में विशेषक्षेत्रीय मिओबीजाणु प्रजातियाँ— रंजीत कुमार कर

अधर गोंडवाना देशों में गुरुपादपाश्म एवं मिओबीजाणु समुच्चयों में परस्पर विलक्षण अनुरूपता है। तथापि, सभी गोंडवाना देशों में परागाणविक दृष्टि से विदित कुछ विशेषक्षेत्रीय मिओबीजाणु प्रजातियाँ विद्यमान हैं। इनमें से ऑस्ट्रेलिया, ब्राजील, भारत, पाकिस्तान उरुगुवे एवं जायरे से ज्ञात कुछ प्रजातियों का वर्णन किया गया है। इन प्रजातियों में अधिकतर अपुष्पोद्भिदों से तथा कई अनावृतबीजीयों से सम्बद्ध हैं। इन प्रजातियों की विशेषक्षेत्रीय प्रकृति का कारण भी विवेचित किया गया है।

INTRODUCTION

MEDLICOTT in an unpublished field report in 1872 first coined the word Gondwana which was later validated by Feistmantel in 1876. Medlicott introduced this term for a group of rocks in Madhya Pradesh, India after the kingdom of Gond, with four distinct lithological characters. The lowermost is conspicuous by the presence of tillites, varvites and other glaciogene rocks, the second is impregnated with coal seams, the third is barren of coal, and the last is volcanic in origin.

Little did Medlicott realise, that he is opening a new vista of geological knowledge and this four fold classification of the Gondwana rocks in India would also be found in Africa, Antarctica, South America and Australia. For example, the lowermost Permo-Carboniferous glaciogene rocks are found as Buckeye tillite in Antarctica, Bacchus Marsh tillite in Australia, Itatara tillite in Brazil, Talchir tillite in India and

Assises glaciaires et périglaciaires in Zaïre (Congo).

The juxtaposition of the different Gondwana provinces for a considerable length of time and similar type of environment resulted the same type of flora — the *Glossopteris-Gangamopteris* flora in all these countries. The lithology and the megafloora are almost identical to each other and it is impossible to tell in the laboratory without prior knowledge from where a particular megafossil has been collected. The miospore assemblage is also broadly similar and in the lower horizon in all the countries it is dominated by monosaccate pollen grains represented by *Cannanoropollis* Potonié & Sah (1961), *Parasaccites* Bharadwaj & Tiwari (1964), *Caheniasaccites* Bose & Kar (1966), *Divarisaccus* Venkatachala & Kar (1966a), etc. In the upper part of the Lower Gondwana, the monosaccates are replaced by the striate-bisaccates and the genera *Striatites* Bharadwaj (1962), *Faunipollenites* Bharadwaj (1962), *Stroter-*

sporites Wilson (1962), *Crescentipollenites* Bharadwaj, Tiwari & Kar (1974) and *Corisaccites* Venkatachala & Kar (1966b) are found in good percentage.

The miospore assemblage of the different Gondwana provinces though look similar but have subtle differences due to ecological and endemic factors. The endemic genera provide the provincial look and some of these miospore genera are described in the present paper.

AUSTRALIA

The Permo-Carboniferous and Permian palynology of Australia have been worked out by Balme and Hennelly (1955, 1956a, 1956b), Balme and Segroves (1966), Segroves (1967, 1970), Evans (1969) and others. The Australian Permian miospores have some forms which are conspicuous by their absence in other parts of Gondwanaland. The most important of all these forms is *Dulhuntyispora* Potonié (1956). This is a triangular-circular, trilete spore whose exoexine is extended into three inter-radial blisters. The exine is structured and may anastomose to provide intra-reticulum.

Peltacysta Balme & Segroves (1966) which resembles *Schizosporis* Cookson & Dettmann (1959) in general organisation has also so far recorded only from Australia. In addition to the presence of a furrow along the equator it also possesses circum-polar ridges or rings of processes in the polar regions. Besides, there are *Mehlisphaeridium* Segroves (1967) and *Spongocystia* Segroves (1967) whose affinities are not clearly known. *Mehlisphaeridium* is two-walled and has small to large, coarse, hollow conical processes.

BRAZIL

The investigation on the palynostratigraphy of the Lower Gondwana deposits in Paraná and Maranhão basins by Bharadwaj, Kar and Navale (1976) revealed many interesting findings. They recorded the occurrence of *Reticulatisporites* (Ibrahim) Neves (1964) — a characteristic lycopsid spore genus so far known from the Upper Carboniferous of Europe and North America from the Maranhão basin of north eastern Brazil. Similarly, they also reported *Striatosporites* Bharadwaj (1954) — a

striated monolete genus so far known only from the Upper Carboniferous of Europe, both from the Lower Permian of Paraná and Maranhão basins.

Reticulatisporites (Ibrahim) Neves (1954) and *Striatosporites* Bharadwaj (1954) are not known in any other Gondwana provinces. The presence of these two typical northern genera in Brazil poses a problem. This obviously points out that the northern Brazil was in proximity of North America and West Europe during Permo-Carboniferous. Creer (1971) on the basis of palaeomagnetic data had already inferred the contiguity of Brazil to North west Africa, North America and West Europe during that time.

Imucogosporis Bharadwaj, Kar & Navale (1976) is an endemic genus of Brazil. This is a trilete spore with triangular-subtriangular shape, the exine is proximally laevigate-sparsely sculptured but distally densely ornamented with grana or coni. An inner thickening is mostly found in the commissural region.

URUGUAY

Very meagre information is available on the Lower Gondwana palynology of Uruguay. However, Marques-Toigo (1970) instituted *Anabaculites* from the glacial deposits of San Gregorio Formation which is so far known only from this province. *Imucogosporis* Bharadwaj, Kar & Navale (1976) comes close to *Anabaculites* in general organisation but the latter is distinguished by its bacular ornamentation on the distal surface, subcircular-oval shape and pronounced inner body.

INDIA

Of all the Gondwana countries, the palynology of Lower Gondwana of India is best known through the work of Potonié and Lele (1961), Bharadwaj (1962), Bharadwaj and Salujha (1964, 1965), Tiwari (1965), Venkatachala and Kar (1964, 1966a, 1966b, 1968, 1969), Lele (1964, 1965, 1975), Lele and Chandra (1969, 1972), Lele and Maithy (1964), Maithy (1965, 1966), Kar (1968a, 1968b, 1969a, 1969b, 1972), Srivastava (1973a, 1973b) and others. It has several endemic genera comprising trilete, monolete and alete spores and bisaccate pollen grains.

Some of these genera are: *Varireticulates* Kar (1969b), *Gondisporites* Bharadwaj (1962), *Mammialestes* Kar (1969b), *Ghoshiasporites* Kar (1969b), *Bharadwajipollis* Kar (1969a), *Tumoriipollenites* Bharadwaj (1962) and *Striapollenites* Bharadwaj (1962).

Varireticulates Kar (1969b) is a subcircular trilete spore. The exine is proximally reticulate and distally laevigate; the trilete rays are associated with regular fold system. It may be stated here that reticulate trilete spores are rare in the Lower Gondwana and occasionally described as *Reticulatisporites* (Ibrahim) Neves (1964), *Dictyotriletes* (Naumova) Potonié & Kremp (1954) and *Greinervillites* Bose & Kar (1967).

Gondisporites Bharadwaj (1962) is a triangular-subtriangular trilete spore with a thin, denticulate, subequatorially attached zona and a large central body which contains a small inner body. *Ghoshiasporites* Kar (1969b) is an oval monolete spore, the exine is proximally laevigate and distally conical. *Mammialestes* Kar (1969b) is ornamented with mammillate processes on both sides.

Bharadwajipollis Kar (1965a) is monosaccate pollen whose central body is striated like *Striomonosaccites* Bharadwaj (1962) and *Distriomonosaccites* Bharadwaj (1962). In *Bharadwajipollis*, however, the saccus is proximally equatorially attached to the central body and it completely covers the central body on the distal side. *Tumoriipollenites* Bharadwaj (1962) is a haploxylonoid, bisaccate pollen with tubercles on the proximal side of central body. *Striapollenites* Bharadwaj (1962) is also bisaccate, bilaterally symmetrical with the presence of vertical striations on the central body. This is a very peculiar genus in having only vertical partitions while in other striate, bisaccate pollen grains both horizontal and vertical striations are present and the horizontal striations generally outnumber the vertical ones.

PAKISTAN

The spores and pollen grains of the Lower Gondwana in Pakistan have been studied by Venkatachala and Kar (1968) and Balme (1970). The assemblage is not very exhaustively known but still one genus, viz., *Cyclofoveolatispora* Venkatachala & Kar (1968) seems to be endemic. This is a

subcircular-circular, trilete spore with foveolate ornamentation on the distal side. *Disulcites* Venkatachala & Kar (1968) is an oval-subcircular, monocolpate pollen with well-marked horizontal striations. This genus is also mostly restricted to this part though it is reported rarely from Zaïre and India.

ZAIRE

The palynology of the Lower Gondwana of Zaïre is well known through the investigation of Høeg, Bose and Manum (1955), Høeg and Bose (1960), Bose and Kar (1966, 1967a, 1967b, 1976), Bose and Maheshwari (1966, 1968), Piérart (1966), Kar and Bose (1967, 1976, 1978a, 1978b, 1978c, 1978d, 1978e), Maheshwari and Kar (1967), etc.

The miospore assemblage has several endemic genera. *Lutorimites* Kar & Bose (1976) is an interesting subcircular, trilete spore genus. It has well-developed exoexine which cracks to form brick-work like pattern. *Neocalamospora* Kar & Bose (1976) looks similar to *Calamospora* Schopf, Wilson & Bentall (1944) by its subcircular shape and laevigate exine, but the former has a very well defined trilete rays and inner body. *Divaricrassus* Kar & Bose (1976) is subcircular-circular, trilete spore with coni on the proximal side and a circular exinal thickening on the distal side in the polar region. *Fundispora* Kar & Bose (1976) is a characteristic subtriangular-subcircular trilete spore with laevigate proximal side. It is distally verrucose-conical — granulose and the verrucae at the equatorial margin generally fused together to provide a zonate-like appearance. *Luenites* Bose & Kar (1967) is an oval spore with ill-developed monolete mark and laevigate ornamentation.

Punctasaccites Bose & Kar (1966) is monosaccate with well-built saccus. Proximal attachment of saccus to central body is equatorial and the distal attachment is subequatorial. The central body is distinct and the exine ornamentation is punctate.

Mabuitasaccites Bose & Kar (1966) is a striate-monosaccate and resembles *Striomonosaccites* Bharadwaj (1962) and *Distriomonosaccites* Bharadwaj (1962) in general characters. *Mabuitasaccites* is, however, unusual in possessing an inner body within central body and both horizontal and vertical striations on the central body.

Besides, there are few genera which are mostly confined to Zaïre but also been recorded from Brazil by Bharadwaj, Kar and Navale (1976). These are *Elilasaccites* Bose & Kar (1966), *Valiasaccites* Bose & Kar (1966), *Hoeegiasaccites* Bose & Kar (1966), *Walikalesaccites* Bose & Kar (1966), *Boutakoffites* Bose & Kar (1966) and *Fusaccolpites* Bose & Kar (1966).

DISCUSSION

The endemic genera mentioned above mostly belong to the cryptogams. It seems that though most of the cryptogams were widespread in various Gondwana provinces but some of them were restricted in distri-

bution perhaps due to ecological and microclimatic factors. Besides, *Bharadwajia-pollis* Kar (1969a), *Tumoripollenites* Bharadwaj (1962) and *Striapollenites* Bharadwaj (1962) of probable gymnospermous origin are so far restricted to India and *Punctasaccites* Bose & Kar (1966) and *Mabuitasaccites* Bose & Kar (1966) to Zaïre (Congo).

As a word of caution it may be mentioned here that some of the genera marked as endemic here may be found later in other provinces of Gondwana as our palaeopalynological knowledge would accumulate. But a few of the genera should always be having restricted distribution in some provinces due to physical, ecological and microclimatic factors.

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