

LOWER CARBONIFEROUS PALYNOMORPHS FROM POTÍ FORMATION, PARNAÍBA BASIN, BRAZIL

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ABSTRACT

A rich and varied miofloral assemblage consisting of Spores, Acritarchs and Chitinozoans is recovered from a sample belonging to the Potí Formation, Parnaíba Basin, Brazil. This assemblage is quite interesting in having characteristic palynomorphs like *Verrucosiporites nitidus*, *Densosporites spitsbergensis*, *Vallatisporites vallatus*, *Dibolisporites microspicatus*, *Florinites guttatus*, *Hymenozonotriletes explanatus*, *Cirratriradites veeversii*, etc. which suggest a stratigraphic range of Tournaisian-Visean to the sample under study. This is being reported first from the western border of this region while some palynological data exist regarding the eastern border. In addition to this, this assemblage has a greater bearing in tackling the stratigraphic problems associated with these sediments. This also can help interpreting the geological data in a better fashion. A comparative study with other known Lower Carboniferous palynozones of Argentina, Australia, United States of America and Great Britain is also attempted.

RESUMO

Uma rica e variada assembléia miofloral consistindo de Esporos, Acritarca e Quitinozoários é descrita em amostra pertencente a Formação Potí, (Bacia do Parnaíba - Brasil). Esta assembléia, constituída por *Verrucosiporites nitidus*, *Densosporites spitsbergensis*, *Vallatisporites vallatus*, *Dibolisporites microspicatus*, *Florinites guttatus*, *Hymenozonotriletes explanatus*, *Cirratriradites veeversii*, sugere um posicionamento estratigráfico no Tournaisiano-Viseano. Pela primeira vez apresentam-se resultados referentes a borda oeste da bacia e confronta-se com alguns dados palinológicos existentes na borda este. Em adição a isto, esta assembléia tem grande valor no esclarecimento de problemas estratigráficos destes sedimentos. Isto também pode ajudar na melhor forma de interpretação dos dados geológicos. Apresenta-se também um estudo comparativo com outras palinozonas conhecidas do Carbonífero Inferior da Argentina, Austrália, Estados Unidos da América e Inglaterra.

INTRODUCTION

Potí Formation has been attracting attention of geologists for quite a long time and a wealth of lithologic and geologic details is available at present. But most of the studies have been confined to lithology and meagre amount of information on the paleontological part. Only very scanty reference is available with regard to palynological aspect except for the information given by Muller (1962) and Daemon (1974).

The sample is tackled from the palynologic point of view bearing in mind the problems associated with Potí Formation. Rich and varied miofloral elements are encountered which encouraged a further detailed study the results of which are being presented in this paper.

The present contribution adds information to solve the field problems like a) Whether the outcrop belongs to the lower or upper member of the Potí Formation? b) What is the stratigraphic position of this outcrop? Especially the

palynological data obtained from the sample are analysed and compared with the known Lower Carboniferous palynozones with other countries. Palynomorphs encountered are listed though the description of the same will be dealt with in other article. But the stratigraphic significance and implications of some of the selected palynomorphs are discussed in this paper.

GEOLOGICAL SET-UP

Latest report of the CPRM by Lima e Leite (1978) gives a well documented account of the stratigraphic sequence of the Parnaíba Basin. The geologic column proposed by them may be utilised for the discussion of the regional geology of the area. Only part of the geologic column which is relevant with the present work is discussed below

Carboniferous	Upper	Stephanian	Piauí Fm
	Middle	Westphalian	
		Namurian	
	Lower	Visean	Potí Fm.
Tournaisian		Longá Fm.	
Devonian	Upper	Famennian	Cabeças Fm.
		Fransnian	Pimenteiras Fm
	Middle	Givetian	
		Eifelian	

The Potí Formation has a concordant relation with the older formation viz. Longá while its upper contact with the younger formation is quite peculiar and interesting. In the area under study Potí Formation has a discordant relation with the Pedra de Fogo Formation with prominent structural features. The geological picture is not very clear and much debate has entered in studying these sediments.

With above points in mind the present work adds to our knowledge especially with regard to the palynological contents of the Potí Formation.

MATERIAL AND METHOD

The material under study is a carbonaceous silt which is slightly micaceous. This is collected

from the outcrop that is situated along the Belém-Brasília (BR-151) road cutting between Colinas de Goiás and Araguaiana. This material is recovered from a 50 cm thick band of arenaceous silty horizon intercalated with greenish yellow silt. The exact locality along with the geology is shown in the Figure 1.

The standard palynological technique using HF, HCl, HNO₃ is adopted to recover maximum number of palynomorphs. The preparation has yielded a wide variety of different kinds of palynomorphs. Photomicrographs are taken with Carl Zeiss microscope and some of them are shown in the plates. The material is preserved in Dept^o de Paleontologia e Estratigrafia, Instituto de Geociências, Universidade de São Paulo, under the numbers GP/4T-50 to GP/4T-52.

MIOFLORAL CONTENTS

The sample has yielded diversified miofloral elements which are dominated by the abundance of spores of different types. Meagre amount of Chitinozoans and Acritarchs are also found. The spores are represented by almost all the infraturma of the Triletes. Monoletes spores too are observed. Very little amount of monosaccate grains are also noticed. The following list gives an idea of the richness and contents of the palynomorphs which are recognised in the sample up to generic levels.

Anteturma SPORITES H. Potonié 1893

Turma Triletes Reinsch emend. Dettmann 1956

Suprasubturma Acavitriletes Dettmann 1963

Infraturma Laevigati Bennie & Kidston emend
Potonié 1956

Genera: *Calamospora*, *Punctatisporites*,

Leiotriletes, *Retusotriletes*.

Infraturma Apiculati Bennie & Kidston emend.

R. Potonié 1956

Subinfraturma Granulati Dybová & Jachowicz
1957

Genera: *Cyclogranisporites* & *Granulatisporites*

Subinfraturma Verrucati Dybová & Jachowicz
1957

Genus: *Verrucosporites*

Subinfraturma Nodati Dybová & Jachowicz
1957

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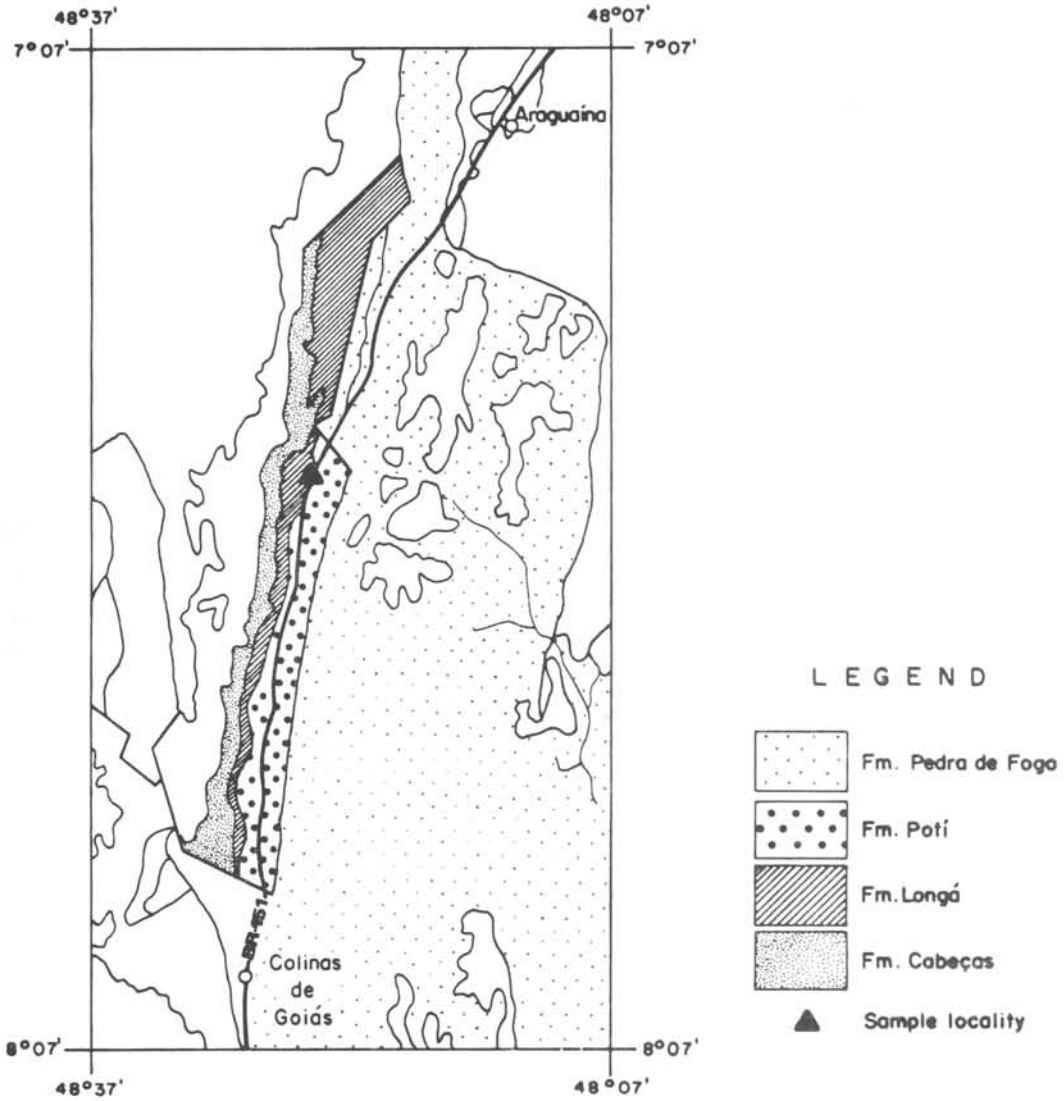


Fig.1 - MAP SHOWING THE LOCALITY OF THE SAMPLE AND GEOLOGY OF THE AREA.

- Genus: *Dibolisporites*
 Subinfraturma Bucalati Dybová & Jachowicz
 1957
- Genus: *Raistrickia*
 Infraturma: Muornati R. Potonié & Kremp
 1954
- Genera: *Convolutispora*, *Dictyotriletes*,
Secarisporites
- Subturma Zonotriletes Waltz 1935
 Infraturma Cingulati R. Potonié & Klaus
 emend. Deuttmann 1963
- Genus *Lophozonotriletes*
 Suprasubturma Laminatitriletes Smith &
 Butterworth 1967
- Subturma Zonolaminatitriletes Smith &
 Butterworth 1967
- Infraturma Crassiti Bharadwaj & Venkatachala
 emend
 Smith & Butterworth 1967
- Genus: *Crassispora*
 Infraturma Cingulicavati Smith & Butterworth
 1967
- Genera: *Cristatisporites*, *Hymenozonotriletes*,
Cirratiradites
- Suprasubturma Pseudosaccitriletes Richardson
 1965
- Infraturma Monopseudosacciti Smith &
 Butterworth 1967
- Genera: *Grandispora* and *Endosporites*

Turma MONOLETES Ibrahim 1933

- Subturma Azonomonoletes Luber 1955
 Infraturma Laevigatomonoleti Dybova &
 Jachowicz
- Genus: *Laevigatosporites* & *Monoletes*

Anteturma POLLENITES Potonié 1931

- Turma Saccites Erdtman 1947
 Subturma Monossacites (Chitaley) Potonié &
 Kremp 1954
- Infraturma Aradiates Bharadwaj 1957
 Genus: *Florinites*
 Infraturma Triletisacciti Leschik 1955
 Genus: *Potonieisporites*

Acritarchs

Chitinozoa

MIOFLORAL ANALYSIS

The miofloral assemblage is dominated by the triletes which are highly ornamented though laevigate triletes are also encountered. In a general way the miospore exines exhibit the kind of sculptural and structural diversity that is consonant with Late Devonian-Early Carboniferous palynofloras. Exines of the large variety of species show granulate verrucate and baculate ornamentation. Single and double layered exines are represented and especially the latter by a variety of forms and pseudosaccate spores. A number of cingulate and crassitude miospore are also observed. Equatorial modifications include cingula, zona and crassitudes.

The range chart demonstrates the efficiency of some selected palynomorphs which clearly delineate the stratigraphic range of the sporomorphs which have been indentified up to the specific level.

COMPARATIVE STUDY

As already mentioned very scanty palynological work has been carried out on the sediments of Poti Fortion. Muller (1962) had recognised spore like *Secarisporites*, *Convolutispora*, *Hymenozonotriletes* which are also recognised in the present study.

Daemon (1974) had given a list of guide palynomorphs for the Devonian and Lower Carboniferous formations of Amazon and Parnaíba basins. He had made observations on the earlier workers like Muller (1962) and Dolianiti (1964) and came to the conclusion that the Poti Formation is of Visean age belonging to the biostratigraphic zone XII. When a comparison is made with the present one many genera like *Raistrickia*, *Densosporites*, *Hymenozonotriletes* etc. are found in both. Though some genera like *Samarisporites*, *Reticulatisporites* are found to be absent in the present study. Moreover there are certain characteristic palynomorphs of Upper Devonian (Longa Formation) and basal Poti Formation like *Biharisporites quadrosii*, *Maranhites brasiliensis*, *Acanthotriletes ciliatus* which are conspicuous by their absence suggestive of Visean age to the sample under study.

RANGE CHART OF SELECTED SPOROMORPHS

STAGE SPORE SPECIES	FAMENNIAN	TOURNAISIAN	VISEAN	NAMURIAN
<i>Hymenozonotriletes explanatus</i>				
<i>Lophozonotriletes malepkensis</i>				
<i>Spelaeotriletes lepidophytus</i>				
<i>Vallatisporites vallatus</i>				
<i>Vallatisporites verrucosus</i>				
<i>Verrucosiporites nitidus</i>				

KEY: Keegan (1977)
 Playford (1978)
 Present work

In contrast to Brazil, the argentinian sediments of Namurian to Westphalian age have been studied in detail with respect to the palynological aspect. Some important palynological publications like Menendez & Azcuy (1969, 1971, 1973), Gonzalez Amicon (1973), Azcuy (1975a, b, c, d), may be cited. A short comparative account may be made with the known data with the present assemblage.

Gonzalez Amicon (1973) described 25 morphological species comprising *Leiotriletes*, *Retusotriletes*, *Verrucosisporites*, *Laevigatosporites*, *Florinites* etc. Most of them also observed in the present study. He concluded that the bulk pattern permits a comparison to the Lagares Formation, La Rioja of Paganzo Basin which is well dated as Namurian. When we compare the present assemblage with the former one notices the absence of important genera/species like *Dibolisporites*, *Verrucosisporites nitidus*, which suggest that the present one is older though some of the elements are commonly found in both. So it is concluded that the present assemblage shows a different aspect though apparently looks to be similar.

Azcuy (1975) had given a succinct summary of the palynological data obtained from the Paganzo Group of Argentina. The whole Paganzo Group had been divided into lower, middle and upper sections of which only the former two divisions had yielded palynofloras. Based on palynological assemblages he had assigned a Namurian-Westphalian to the lower section and Sakmarian to the middle section. He had also given an extensive list of the characteristic Namurian-Westphalian palynomorphs which include *Leiotriletes intermis*, *Leiotriletes politus*, *Vallatisporites ciliaris*, *Laevigatosporites vulgaris*, *Punctatisporites glaber* which are also found in the present assemblage. Here again there is a total absence of forms like *Verrucosisporites nitidus*, *Vallatisporites verrucosus* etc. which suggest a Tournaisian-Visean age. Though some similarities exist between the Namurian Westphalian and the present one, more amount of difference exists between the two. It has elements which are definitely indicative of another age when we take the whole assemblage into consideration.

One interesting point as observed by him is the dominance of Northern elements mainly

from the Great Britain rather than from the Southern hemisphere. The same point is also being confirmed in the present observation.

Playford (1976, 1977, 1978) had given a very detailed palynological information on the Lower Carboniferous sediments of Drummond Basin, Queensland. It is worth noting that many of the palynomorphs are very much the same up to the specific levels. For instance some like *Vallatisporites verrucosus*, *Verrucosisporites nitidus*, *Dibolisporites microspicatus* may be cited. Most of the forms which are common to both point Tournaisian-Visean age. In this way the present assemblage is more akin to the one suggested cited by Playford (1978).

A vast amount of palynological data is gathered on Irish Tournaisian-Visean. Clayton et al. (1977) had given an elaborate account of Irish palynomorphs. Similarly, Keegan (1979) had described many species of palynomorphs with their stratigraphic ranges. The salient feature of this assemblage is the greater similarity with the present assemblage. Many have the same species in both. Hence it is felt that the present assemblage has very close and utmost similarity with the Irish assemblage which once again confirms the idea that there is more evidence of northern elements agreeing with the view of Azcuy (1975).

Felix and Burbridge (1967) studied in detail the palynological contents of the Springer Formation of Southern Oklahoma U.S.A. and assigned an age Tournaisian-Westphalian B. Some of the palynomorphs are commonly observed in both.

So it is noted that the present assemblage is more in common with the northern elements of U.S.A. and Great Britain than with the southern elements of Argentina and Australia.

CONCLUSIONS

The sample from Poti Formation is highly suggestive of an age ranging from Tournaisian-Visean as could be seen from the range chart and also by the presence of certain characteristic Tournaisian-Visean palynomorphs recorded from the other parts of the world. Added to it there is total absence of palynomorphs reported from the Longá Formation which the Poti Formation overlies. The sample under

study in all probability might be from the upper part of the Potí Formation since many forms reported by Daemon (1974) from the basal part are absent in the present assemblage. Moreover as cited by Daemon (1974) of the work of Dolianiti (1964) include some megafossils from the upper part which are attributed to

Lower Carboniferous age. Many of the present palynomorphs may be found affinity with such megafloora.

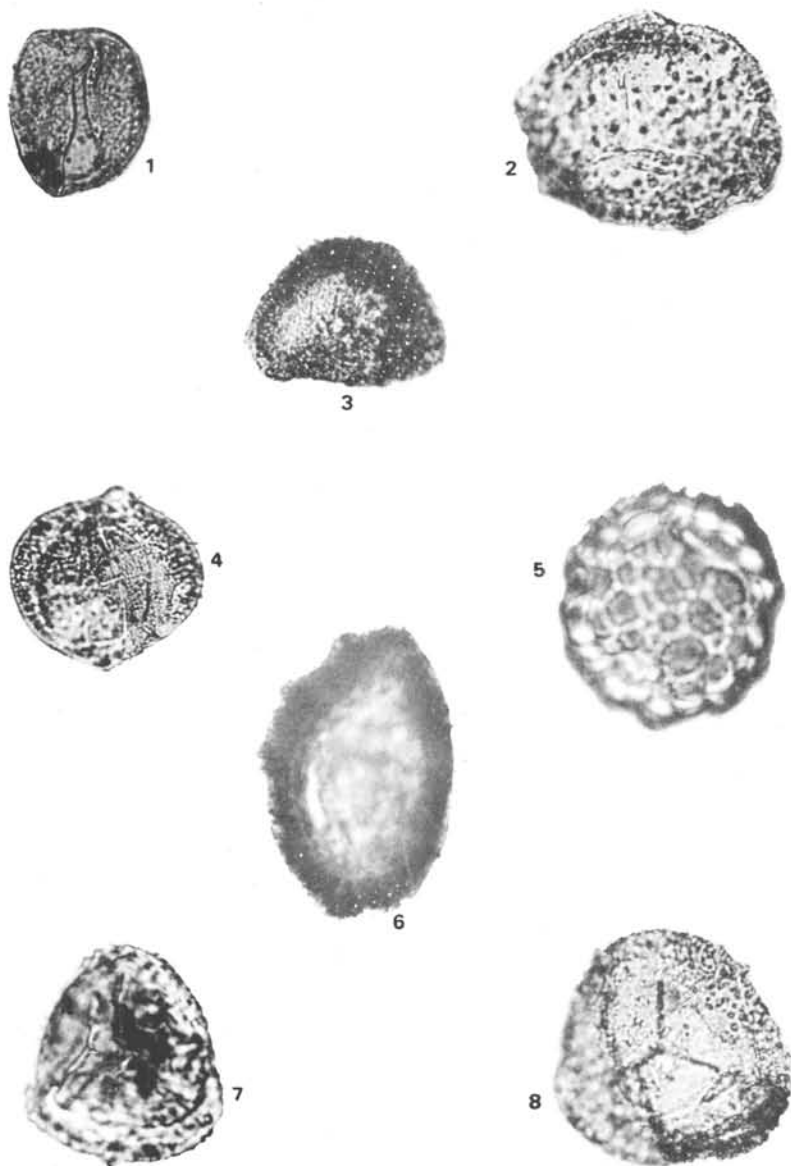
The present assemblage including Acritarchs and Chitinozoans is suggestive of marine influence. It is more likely that the environment of deposition is nearshore.

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PLATE 1



EXPLANATION OF PLATE 1

(All figures x900)

- 1. *Monoletes ovatus*
- 2. *Vallatisporites verrucosus*
- 3. *Densosporites* sp.
- 4. *Florinites guttatus*

- 5. *Verucosporites nitidus*
- 6. *Densosporites spitsbergensis*
- 7. *Vallatisporites vallatus*
- 8. *Dibolisporites microspicatus*