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AUSTRALIAN BICENTENNIAL ISSUE

Editor's Note: January 26 is **Australia Day**, which commemorates the arrival of the "First Fleet" in 1788 from Great Britain at Botany Bay, just south of the present location of Sydney, NSW. In honor of the Australian Bicentennial, as well as in anticipation of the 7th International Palynological Congress to be held in Brisbane Aug. 28-Sept. 3, this issue is devoted to an account of the past and present accomplishments of Australian and New Zealand palynologists.

HISTORICAL REVIEW OF PALYNOLOGY IN AUSTRALIA AND NEW ZEALAND

EASTERN AUSTRALIA

by **N.J. de Jersey**
(Geological Survey of
Queensland, Brisbane)

The earliest paper on a specifically palynological topic is that of **Newton** (1875) on *Tasmanites* from Permian oil shales in Tasmania. Other early papers were those on Kerosene shale from the Permian of New South Wales by **Bertrand** and **Renault** (1894) and **Bertrand** (1896). The earliest papers on Palaeozoic spores and pollen were those of **Virkki**, who described taeniate bisaccate pollen from the Permian of the Newcastle Coal Measures (1937) and monosaccate spores from the Permo-Carboniferous Bacchus Marsh tillite of Victoria (1939). She noted their close similarity, in each case, to pollen and spores from Lower Gondwana shales in India.

However, there was no detailed systematic study of Australian palynology until the time of **Isabel Cookson**, who commenced her work on pollen from Victorian brown coals in the 1940's. The scope of the research was widened to include material from other Tertiary sediments in Victoria, and Tertiary and Cretaceous material from other states and overseas localities. Co-workers who collaborated in these studies in the 1950's were **Suzanne Duigan**, **Kathleen Pike** and **Mary Dettmann**. From the late 1950's, **Isabel Cookson** became increasingly interested in dinoflagellates and acritarchs, associated with the pollen and spores in some of the Cretaceous and Tertiary assemblages, and her research concentrated more and more on microplankton studies until her death in 1973. As a result, she must also be regarded as the pioneer of dinoflagellate studies in Australia.

The first comprehensive study of Palaeozoic material was that of **Dulhunty** (1946), who described spores and pollen from Permian coals of New South Wales, using a numerical system of nomenclature. This system was applied to material from Queensland Permian coals and Triassic coals

from Ipswich, Queensland by **de Jersey** (1946, 1949). These initial studies demonstrated the wide variety of pollen and spore species available for study in these Permian and Triassic coals. They were followed by three major papers by **Balme** and **Hennelly** on spores and pollen from Australian Permian sediments. These papers (1955-56) initiated the use of binomial nomenclature for Australian Permian material.

In eastern Australia, binomial nomenclature was first applied to Mesozoic palynofloras in a paper on Jurassic spores and pollen from the Rosewood coalfield (**de Jersey**, 1959) and subsequently extended in the 1960's and 1970's to other areas and other periods. Co-workers at the Geological Survey of Queensland have included **Dick Paten**, **Marion Hamilton**, **Alan Williams**, **John Rigby**, **Heinz Hekel**, **John McKellar** and **Clinton Foster**.

Also in Brisbane, the 1963 appointment of **Geoff Playford** to a lecturing post at the University of Queensland has been of significant value to Australian palynology. As well as being a very active researcher and publisher, he has trained several students who have taken their places in the Australian palynological community.

In Sydney, **Robin Helby** has been an active worker since the early 1970's, initially working on Triassic, Permian and Carboniferous material, and more recently on Mesozoic dinoflagellates.

In the 1960's biostratigraphic studies were stimulated by the discovery of commercially productive oil and gas fields, commencing with the Moonie oilfield, in the Surat Basin of southern



Proteacidites pachypolus Cookson & Pike 1954. (The species on which the logo for 7 IPC is based).

Queensland. **Dick Evans**, at the Bureau of Mineral Resources, Canberra, played a leading part in developing a numerical system of zonation and applying it to the wealth of material from exploratory wells. Detailed palynostratigraphic work associated with petroleum search was subsequently taken over by company laboratories, including in Brisbane that of Mines Administration Pty Ltd (since taken over by CSR Ltd), with principal workers initially **Dick Paten**, later **Peter Price** and **John Filatoff**; and in Sydney that of Esso (principal workers initially **Dick Evans** and later **Lew Stover** and **Alan Partridge**).

The Esso palynologists have worked primarily on Tertiary and late Cretaceous material from Bass Strait sequences. Other workers on Tertiary palynofloras are **Helene Martin** and **Wayne Harris**, who have published on Tertiary assemblages of New South Wales and southeastern Australia, respectively.

Elizabeth Kemp Truswell (Bureau of Mineral Resources) has worked on both Tertiary and Permian palynofloras from the Australasian region.

Studies of Cretaceous material were also stimulated by petroleum exploration. Detailed systematic work was initiated in 1963 by **Mary Dettmann**; more recently **Dennis Burger** (Bureau of Mineral Resources), **Dick Evans**, **Lew Stover** and **Alan Partridge** (Esso) and **Roger Morgan** (Geological Survey of New South Wales) have made major contributions.

Quaternary studies were initiated by **Donald Walker** at the Australian National University, Canberra, in 1961. At Monash University in Melbourne, another group working on Quaternary material was formed in 1967 under the leadership of **David Churchill**; **Peter Kershaw** established a new group in 1972. These groups have made major contributions to our knowledge of Australian palynofloras of Quaternary age.

Palynological study of the extant flora has been carried out by **Bruce Knox** and co-workers at the University of Melbourne since early 1982. This work has been of major significance in investigation of the pollination process and in allergen studies.

In the present decade, the majority of the research groups mentioned have remained active and there has been some diversification of palynological activities.

WESTERN AUSTRALIA

by **B.E. Balme**

(Univ. of Western Australia, Nedlands)

Palynological research in Western Australia began in the 1950's, coincident with the first systematic oil exploration drilling, which made obvious the then rudimentary understanding of the State's stratigraphy. Plant microfossil studies of pre-Holocene strata were initiated by **Isabel Cookson** and **Basil Balme**, and most of the early published papers were short contributions dealing with *ad hoc* stratigraphic problems (e.g., **Cookson**, 1954; **Balme**, 1956; **Balme & Churchill**, 1959). However, some of the data were incorporated in more substantial accounts, such as the early monograph on dinoflagellates by **Deflandre & Cookson** (1954) and the palynostratigraphic survey of Jurassic-Early Cretaceous microfossil assemblages of **Balme** (1957).

Expansion of drilling activity and the encouragement of hydrocarbon discoveries in the Perth and offshore Carnarvon Basins led to intensification of palynological activity in the 1960's and early 1970's. A palynological section was established by the Geological Survey in 1962, and **Barry Ingram** was appointed as a full-time palynologist in 1965, and was joined in 1968 by **John Backhouse**. Palynological facilities were set up by a number of exploration companies, and **Balme** and his students carried out a wide range of projects on Palaeozoic and Mesozoic sequences. **Ken Segroves** made important contributions to the knowledge of Permian freshwater algal cysts; **John Filatoff** (1975) produced a monograph on Jurassic palynology, and **Jan Dolby** carried out a comprehensive study of the newly discovered Triassic section in the offshore areas of the Carnarvon Basin. **Balme's** own published work during this period dealt mainly with the Devonian and Triassic. During this period, too, collaboration between **Isabel Cookson** and **Alfred Eisenack** produced an important series of pioneering papers on fossil dinoflagellate cysts.

Since the late 1970's, emphasis within the major oil companies has shifted towards development, with a consequent decline in their palynological activities related to exploration. As a result, continuing palyno-

logical studies during the past 7-8 years have been virtually restricted to the Geological Survey and universities.

At the Geological Survey, **John Backhouse** and **Kath Grey** have published on Cretaceous and mid-Devonian palynology, respectively. University contributions include work on the systematics of Palaeozoic spores and acritarchs by **Geoffrey Playford** and his associates (University of Queensland) and, at the University of Western Australia, studies of Late Palaeozoic glacial sequences (**Gary Powis**) and Mesozoic dinoflagellates (**Neil Marshall** and **Frances Parker**).

SOUTH AUSTRALIA

by **B.E. Balme**

Material from South Australian sequences was incorporated in several early Australian palynological papers (e.g., **Pike**, 1949; **Cookson**, 1953) and **Geoffrey Taylor** made a preliminary study of the palynology of Leigh Creek coals in 1953. Systematic studies effectively began in 1952 when **Wayne Harris** was appointed to the Geological Survey of South Australia. He made considerable contributions to the understanding of the State's stratigraphy, many of which are documented as short published accounts without formal systematics. Harris's more comprehensive papers dealt mainly with Tertiary palynology of other Australian states, although one account (**Harris**, 1972) provides important South Australian data. The other two important systematic contributions from South Australia treat the Permian (**Foster**, 1974) and Late Triassic (**Playford & Dettmann**, 1965).

Since **Wayne Harris** resigned from the Geological Survey some years ago to join Western Mining Corporation, palynological studies in that organisation have been continued by **Barry Cooper** and **Neville Alley**.

The first publication concerning South Australian Holocene material was by **John Dodson** (1977).



NEW ZEALAND

by **D.C. Mildenhall**
(Geological Survey
N.Z., Lower Hutt)

The first record of fossil plants from New Zealand was at the time of Captain James Cook's first voyage to New Zealand in 1769, although the indigenous Maori undoubtedly made use of fossil wood found in the numerous swamps. The oldest reference to stratigraphic palynology in New Zealand was by **G.E. Erdtman** in 1925, who briefly mentioned the presence of rubiaceous and coniferous pollen in the peats of Otago and Chatham Islands. The first published illustration of fossil terrestrial palynomorphs was made in 1934 with drawings by **W.N. Edwards** of the spores of the Jurassic fern *Coniopteris hymenophylloides* (Brong.). This was immediately followed by publication of summary pollen diagrams of Holocene and last glaciation sequences by **Lucy M. Cranwell** and **Lennert Von Post**. The first mention of marine or freshwater dinoflagellate cysts was the description of *Lithoperidinium* (now *Peridinites*) *oamaruense* by **G. Deflandre** in 1933.

Detailed palynological work was initially undertaken at the Auckland War Memorial Museum by **L. M. Cranwell**, later assisted by **W.F. Harris** between the years 1935 and 1944. Work concentrated on the classification and description of the spores and pollen of the modern New Zealand flora and the application of this to late Quaternary peats. All subsequent work was based on this pioneering work of **L.M. Cranwell**, who built up a reference collection of modern New Zealand spores and pollen and published brief keys to their identification.

After the Second World War, palynology, as a tool in taxonomy, biostratigraphy and paleoecology, blossomed in both the Botany Division and the New Zealand Geological Survey, both divisions of the Department of Scientific and Industrial Research, a then fully-funded Government department. Most palynological work has been done by these two divisions up to the present day.

Botany Division concentrated on pollen morphology, hay-fever (now dropped), studies of the modern pollen rain, melissopalynology (initially begun by **R. Waters** as early as 1915), atmospheric dispersal (in-

cluding trans-oceanic), and above all, late Quaternary pollen analysis. Most of this work has been carried out by **N.T. Moar** and **M.S. McGlone**. Together they have established detailed pollen diagrams covering many sites around New Zealand, its off-shore islands and some sub-Antarctic Islands. Vegetational and climatic changes over the last 100,000 years in particular are now well-documented for large areas of New Zealand.

At the New Zealand Geological Survey, work on older material was commenced by **R.A. Couper** in 1949, influenced by the earlier success of one of his lecturers at Victoria University of Wellington, **M.T. Te Punga**, who had successfully extracted *Nothofagus* (and other) pollen from late Cretaceous coal. **Couper** spent the next ten years describing (mainly) Cretaceous to early Quaternary spores and pollen, and placing their ranges into divisions based on marine sequences studied by workers on Mollusca and Foraminifera.

Just before Couper left in 1958 to join a Dutch oil company, he was joined by **W.F. Harris** who had previously worked for both the Botany Division and the Soil Bureau as a palynologist. **Harris** concentrated on Quaternary palynology, and although his published works have been few, they have had considerable influence on subsequent workers. The initial work of **Couper** and **Harris** (who retired in 1968) was carried on by **G. Norris**, **D.J. McIntyre** (both now working in Canada), **D.C. Mildenhall**, **G.J. Wilson**, **J.I. Raine** and **D.T. Pocknall**, with a corresponding increase in the range of palynological activities undertaken, but concentrating primarily on establishing a terrestrial palynomorph zonation scheme for the Mesozoic, Tertiary and early Quaternary. In spite of its relatively small size, New Zealand has an almost continuous, and thick, sequence of marine and terrestrial rocks covering these periods.



NAMES AND ABBREVIATIONS USED IN TEXT

AUSTRALIA		NEW ZEALAND		AUSTRALIAN BASINS	
Adelaide	University of Adelaide	U. Adel	Auckland	Auckland University	1 Bonaparte
Brisbane	University of Queensland	U. Qld	Christchurch	Canterbury University	2 Canning
Canberra	Australian National University	ANU	Dunedin	Botany Division (DSIR)	3 Carnarvon
	CSIRO Land and Water Resources	BMR	Lower Hutt	Otago University	4 Perth
	Bureau of Mineral Resources	U. Tas	Palmerston North	New Zealand Geological Service (DSIR)	5 Colliie
Hobart	University of Tasmania	Mon U	Wellington	Massey University	6 Arckaringa
Melbourne	Monash University	U. Melb.			7 Cooper
Newcastle	University of Newcastle	U. New.			8 Murray
Perth	Murdoch University	Murd U.			9 Gippsland
	University of W.A.	U. WA			10 Sydney
Sydney	Macquarie University	MacQ U.			11 Gunnedah
	University of N.S.W.	U. NSW			12 Surat
	University of Sydney	U. Syd.			13 Clarence-Morton
Wollongong	University of Wollongong	U. Woll.			14 Bowen
					15 Galilee
					16 Eromanga

CURRENT PALYNOLOGICAL ACTIVITIES IN AUSTRALIA

compiled by **H.A. Martin**
(Univ. NSW, Sydney)

PALAEOZOIC and MESOZOIC

by **A. McMinn**
(NSW Geol. Survey, Sydney)

Palaeozoic: Ordovician acritarchs and chitinozoa and Devonian to Carboniferous acritarchs and spores are being studied by **G. Playford** (U. Qld). **C. Foster** (Western Mining Corporation, Adelaide) is investigating the Ordovician palynology of the Canning Basin. **B.E. Balme** (U.WA) is working on the early Upper Devonian of the Carnarvon Basin and, jointly with **R. Helby** (consultant, Sydney), the older Devonian of the Canning Basin of Western Australia. **M.J. Jones** (SANTOS) is investigating the Carboniferous palynology of the Galilee Basin, Queensland.

Late Carboniferous and Permian sediments are widespread and of major economic importance in Australia and consequently have received significant palynological attention. Current investigators include **C. Foster** in the Canning Basin, **H. Grenfell** (U. Syd.) in the Bonaparte Basin, and **J. Backhouse** (W.A. Geol. Surv., Perth) in the Colli and Perth Basins of Western Australia. **P. Price** (CSR, Brisbane), **M.J. Jones** and **G.R. Wood** (SANTOS, Adelaide) in the Cooper, Bowen and Arckaringa Basins of South Australia and Queensland. **A. McMinn** (NSW Geol. Surv., Sydney) is investigating the Permian sequence of the Sydney and Gunnedah Basins, NSW.

Mesozoic: Relatively complete, largely non-marine Mesozoic sequences are found extensively across eastern Australia. The Eromanga Basin sequence of Qld, SA and the Northern Territory is being investigated by **J. Filatoff** (CSR, Brisbane) and **G. Wood** and **D. Burger** (BMR); **A. McMinn** is investigating the NSW section of this basin. The Surat and Clarence-Morton Basin sequences in Qld and NSW are being investigated by **J. Mackellar** (Qld. Geol. Surv., Brisbane), **N.J. de Jersey** (Qld. Geol. Surv., Brisbane), **A. McMinn**, **D. Burger** and **S. Pickering** (consul-

tant, Sydney). Other current investigations include the Cretaceous palynostratigraphy of Australia and Antarctica by **M.E. Dettmann** (U. Qld); Late Cretaceous dinoflagellates from Western Australia by **A. McMinn** and **N. Marshall** (U. Syd.); and Middle Jurassic dinoflagellates of Australia by **R. Morgan** (consultant, Maitland, SA). A major Mesozoic, spore-pollen and dinoflagellate zonation has recently been completed by **R. Helby** (consultant, Sydney), **R. Morgan** and **A.D. Partridge** (ESSO, Sydney).

In addition to the above projects, most industrial and government palynologists routinely examine samples from a wide variety of ages and environments.

TERTIARY

The palynomorphs of the Tertiary brown coals of the Latrobe Valley in Victoria are being studied by **A.P. Kershaw** (Mon. U.). The Tertiary sequence of the Murray Basin, important for groundwater, is being studied by **E.M. Truswell** (BMR), **M.K. Macphail** (consultant, Sydney) and **H.A. Martin** (U. NSW). The Tertiary alluvial fill in the river valleys in NSW are also important for groundwater and are being studied by **H.A. Martin**. Thick sections of Tertiary sediments are encountered in the southeastern offshore basins of interest to oil exploration.

Lake George sediments extend into the late Tertiary and are being studied by **J. McEwen Mason** (Mon. U.). **N.F. Alley** (S.A. Geol. Surv., Adelaide) works on the Tertiary of small basins in SA. Besides the workers mentioned above, most government-employed palynologists routinely examine Tertiary deposits.

Most interest in the Tertiary centres on correlations between numerous isolated deposits. The sequence in the Gippsland Basin (Victoria) has been independently dated and the consequent zonation is used by most Tertiary palynologists. However, the inland deposits, especially of Miocene age and younger, are not readily fitted into this zonation and independent dating is being developed for the northwest part of the Murray Basin in New South Wales.

Interpretations of Australian Tertiary vegetation and climate are being pursued by **A.P. Kershaw**, **M.K. Macphail** and **H.A. Martin**.

Two palynologists based in SE Australia have research interests else-

where. **I.R. Sluiter** (Mon. U.) is studying the Cainozoic palaeodrainage systems in Central and Western Australia. **M. Watanasak** (U. Adel.) has interests in tropical Australasia, SE Asia and Thailand.

QUARTERNARY

by **J. Dodson** (U.NSW, Sydney)

Most of our work has been concentrated on the vegetation and environmental history of Australia, mainly of Holocene age. Rainforest history is being constructed in northeastern Australia by **A.P. Kershaw** (Mon.U.), **J. Owen** and **D. Walker** (ANU), and in subtropical and cool temperate southeastern Australia by **E. Colhoun** (U. New.), **J. Dodson**, **P. Kodala** (U. NSW), **M. Macphail** (consultant, Sydney) and **G. van de Geer** (U. Tas.). Work in the sub-humid eucalypt formations has been recently published or is underway by the following individuals: **J. Chalson**, **J. Dodson**, **P. Kodala** (U. NSW); **A.R.H. Martin** (U. Syd.); **R. Clark** (CSIRO); **L. Head** (U. Woll.); **G. Hope**, **G. Singh**, **W. Southern**, **J. Williams** (ANU); **A.P. Kershaw**, **J. McEwen Mason** and **M. McKenzie** (Mon. U.). Sites in the arid and semi-arid zones are being worked by **W. Boyd** (U. Adel.), **J. Luly**, **G. Singh** (ANU) and **J. Dodson**.

Sub-Antarctic, alpine and sub-alpine sites have been studied by **D. Bergstrom**, **D. Selkirk**, **P. Selkirk** (Macq. U.); **J. Dodson**, **K. Hodge** (U. NSW); **J. Raine** (Geol. Surv., N.Z.); **P. Ladd** (Murd. U.); **A.R.H. Martin**, **A.P. Kershaw** and **M. MacPhail**. In addition, some special coastal environments have received attention from **J. Grindrod** and **M. Macphail**. While this seems to be a considerable body of research work, the size of Australia and the diversity of its habitats leaves much still to be studied.

There is considerable work to be done on calibrating the pollen-vegetation-environmental relationships. Most workers undertake some studies on modern pollen rain, but the only comprehensive work currently underway is that by **J. Dodson** and **G. Singh**, who are studying pollen influx rates in a variety of situations, from the arid interior through the tablelands to southeastern coastal environments.

Fine resolution work, with the aim of determining how vegetation behaves and the kinds of interactions between taxa at the ecological scale, are underway in tropical rain-

forest (**J. Owen** and **D. Walker**); sub-tropical and cool temperate rainforest (**J. Dodson** and **P. Kodala**); sub-alpine woodland (**D. Green** and **G. Singh**); and in woodland and forests (**R. Clark**).

Other studies include palaeomagnetism and palynology to date early-mid-Quaternary vegetation at Lake George (**J. McEwen Mason**, (Mon. U.)). **D. Walker**, (ANU) is working on schemes for reducing loss of pollen during laboratory preparation of sediments.

Work overseas is being carried out by **D. Walker** in collaboration with workers in China, and **D. Singh** (ANU) is investigating vegetation and climatic history in Rajasthan (northwest India); both these studies are aimed at quantifying the contributions of monsoons in vegetation and human habitation patterns. **G. Hope** continues to investigate glacial environmental history in alpine regions in Indonesia. **A.P. Kershaw**, **K. Strickland** and **J. Dodson** are currently working on vegetation histories for sites in Northland, New Zealand, and **J. Dodson** is investigating the role of fire in heathland management and blanket bog spread in western Ireland.

A. McMinn (Geol. Surv., NSW) is investigating the recent distribution of dinoflagellates in estuaries of eastern and northern Australia, with a view to understanding the palaeoecology of Pleistocene dinoflagellates. **A. O'Connor** (U. WA) has worked on diatoms.

PALYNOLOGY and ARCHAEOLOGY

by **G. Hope** (ANU, Canberra)

The application of pollen analysis to prehistoric problems in Australia has largely been that of interpreting regional or local environments. Rock shelters, e.g., the Nullabor, (**H.A. Martin**, U. NSW) and the Bass Strait region (**G. Hope**, ANU) and open sites in Victoria and NSW (**P. Ladd**, Murd. U.) and Bass Strait region (**Hope**, **Ladd**) have been worked, but may be difficult to interpret. Swamp and lake cores which give evidence of food plants, burning and regional resources are more important. Archaeological deposits have been integrated with nearby organic cores in Tasmania (**Thomas**, U. Tas., **Hope**); Victoria (**L. Head**, U. Woll., **P. Edney**, **A.P. Kershaw**, Mon. U. and **G. Hope**); South Australia (**J. Dodson**, U. NSW, **L. Clark**, CSIRO): ACT (**Hope**,

Clark); Queensland (**D. Walker**, ANU and **A. Kershaw**); Kakadu, NT (**Russell-Smith** and **Hope**) and western WA (**Pederson**, U. WA). Some cores investigated for general reasons have provided equivocal data on the early impact of fire with a possible anthropogenic origin, e.g., Lake George NSW; Lake Frome, SA (**G. Singh**, ANU); Lynchies Crater, NE Qld (**A. Kershaw**). An attempt is being made to see if offshore carbonised particle loads in the Tasman Sea may provide independent evidence of fire frequency changes (**Hope**).

The impact of humans more than 40,000 years ago was probably profound, but given a natural fire regime and the dispersed culture of regional hunting and collecting, the details of this impact are still being argued. Most Australian palynologists who work in Quaternary horizons have an interest in anthropogenic vegetation change, but none would class this as a major employment.

Australian palynologists have worked with pre-historians in Fiji (**Southern**, ANU), Papua New Guinea (**Hope**, **Southern**) and Indonesia (**Hope** and **Tulip**, ANU). **W. Boyd** (U. Adel.) has worked on Scottish archaeological studies.

So far, then, the results have been mainly of general use. There is a lot of scope for improved identification of food plants and their possible manipulation and husbandry. With a few exceptions, the palynology of the arid areas of Australia has been disappointing in not matching the rich archaeological record.

PALYNOLOGY and TAXONOMY

Palynology is routinely employed by many taxonomists. Some of the groups being studied are Myrtaceae (**P. Gadek**, U. NSW, **P.G. Wilson**, National Herbarium of Australia, Sydney); Coniferales (**Gadek**); Monimiaceae/Atherospermaceae (**D.B. Foreman**, National Herbarium of Victoria, Melbourne); Scrophulariaceae, Tribe Gratiolaeae and *Hakea* (**W. R. Barker**, State Herbarium of South Australia).

AEROBIOLOGY

by **D. Bass**

In Sydney, **G. Katelaris** (Westmead Hospital) is counting both mould and pollen on two Seven-Day Burkard Spore traps situated on top of the Westmead Hospital about 30 km from the coast. **R. Baker**, (Mac-

quarie Street, Sydney), is particularly interested in airborne mould and monitors daily counts in the City of Sydney. **D. Bass** counts and graphs pollen and notes mould at three sites (two in Sydney near Sydney Harbour and one in Canberra) and correlates these with symptom scores mainly with seasonal hay fever sufferers, but also in perennial graphs pollen and notes rhinitis in mould allergic people.

L. McShane (Hunter Immunology Unit, Newcastle Hospital) counts airborne pollen at Newcastle and the Hunter Valley and compares differences between the rural area and the industrial areas. The Department of Botany (U. Melb.) has for many years correlated aerobiological data with asthma in children.

Both **A. Gale** and **S. Birdseye** monitor pollen and mould spores in Adelaide and correlate counts with meteorological data.

The Asthma Foundation is funding pollen monitoring in Western Australia. Most work is being correlated with weather data to establish differences in inland and coastal patterns.

In the past, there have been excellent studies conducted in Brisbane and Tasmania which are still relevant, in spite of great changes in pasture and forestry management in recent decades.

PETROLEUM EXPLORATION PALYNOLOGY

Palynology has been an important tool for the petroleum exploration industry since the first discoveries of commercial oil and gas fields in Australia in the early 1960s. The initial commercial finds in Mesozoic sequences in the Surat and Carnarvon Basins and Tertiary sequences in the Gippsland Basin all relied on palynology for the correlation and age dating of reservoirs. Since then, all the important hydrocarbon accumulations discovered in Australia have been found in non-marine to marginal marine clastic sequences, which are either barren or impoverished of calcareous microfossils.

In general, the Australian petroleum industry has initially used consultants, followed by the larger or most successful companies establishing in-house palynology laboratories. During the 1970s an average of 9 palynologists were continually employed within the industry. This number increased to a maximum of

21 in the early 1980s, with most palynologists being employed in company-operated laboratories. Since the collapse in world oil prices in 1986, there has been a decrease of employment opportunities with the major Australian companies and a corresponding increase in palynologists seeking work as consultants. Behind the average numbers is considerable fluidity as new people have entered the industry, while others have left palynology to work as geologists or have been promoted into managerial positions. The situation as of July 1987 is as follows:

Western Australia: Woodside Offshore Petroleum has the only industry laboratory in Perth; it is currently staffed by **Tony Bint**, who works mainly on Mesozoic palynology. The consultants are **Barry Ingram** (Western Palynoservices), **Dirk Hos** and **Aziz Islam** (formerly with the consulting company ECL Australia Pty Ltd) and **Robyn Purcell**.

South Australia: **Clinton Foster** and **Fran Parker** work at the Western Mining Corporation Laboratory, while **Wayne Harris** (who set up this lab) has become Regional Exploration Manager. **Geoff Wood** and **Murray Jones** work on the Cooper Basin at Santos Ltd. Both transferred to Santos following the changes to the operatorship in the Cooper Basin joint venture after the purchase by Esso Australia Ltd. of Delhi Petroleum Pty Ltd. **Roger Morgan** of Maitland, SA., consults.

New South Wales: **Alan Partridge** and **Mike Hannah** work in the Biostratigraphic Group at Esso Australia Ltd., Sydney. **Jill Stevens** and **Gary Powis**, formerly with this group, now work as geologists at Esso. Consultants in NSW are **Robin Helby**, **Michael Macphail**, **Helene Martin**, and **Shirley Pickering**.

Queensland: **Peter Price** and **John Filatoff** are palynologists with CSR Oil & Gas Division in Brisbane. Consultants in Queensland are **Heinz Hekel** and **Lynne Milne**.



CURRENT PALYNOLOGICAL ACTIVITIES IN NEW ZEALAND

by **D.C. Mildenhall**
(NZGS, Lower Hutt)

New Zealand is a long, narrow country, stretching over 13° of latitude. Within this area a relatively large number of sedimentary basins occur with very thick late Cretaceous to Quaternary sequences. Consequently, most palynologists and paleobotanists in New Zealand tend to work in strata within this range. The generally high rank of pre-Cretaceous rocks makes palynological analysis less rewarding than in younger material, although rich assemblages are now known from the Triassic and Jurassic, partly as a result of vastly improved techniques.

Paleozoic: Apart from occasional acritarchs from Cambrian and Ordovician rocks, no palynomorphs have been recovered from rocks older than Permian. Some work is currently being done in the Permian; exploratory accounts have been published by **G.J. Wilson** and **Y.M. Crosbie**, New Zealand Geological Survey (NZGS).

Mesozoic: Mesozoic palynomorphs (spores, pollen, acritarchs, dinoflagellates) are studied at NZGS (**J.I. Raine**, **Wilson**) and by students at Canterbury University (CU) (**K. Browne**, **M. Warnes**). Most emphasis has been placed on the zonation of Cretaceous sequences and associated taxonomy. **Raine**, in association with **N. de Jersey** (Queensland Geological Survey), has produced a zonation and associated taxonomy of Triassic palynomorphs. **Wilson** has produced a late Jurassic to Eocene dinoflagellate biostratigraphy for New Zealand. **Browne** and **Warnes** have studied late Cretaceous coal measures, providing local zonations.

R. Helby (Sydney) is studying dinoflagellates of the mid-upper Jurassic Kawhia sequence, assisted by **N. Hudson** and **J.A. Grant-Mackie** (Auckland University), and by **Wilson** on a separate project.

Tertiary: Tertiary palynomorphs are studied at NZGS (**D.C. Mildenhall**, **D.T. Pocknall**, **Raine**, **Wilson**) and at Canterbury University (**Browne**, **Warnes**, **M. Wright**). Some emphasis has recently been placed on the Cretaceous/Tertiary

boundary in both marine (**Wilson**) and terrestrial (**Raine**, **Browne**, **Warnes**) sequences. While the iridium anomaly has been picked up, no dramatic floral changes are apparent across the K/T boundary. A pollen zonation for terrestrial sediments of Cretaceous and early Tertiary age by **Raine** for the West Coast of South Island is generally applicable to other parts of New Zealand. This has been supplemented by a mid-Tertiary zonation for southern South Island by **Pocknall** and **Mildenhall**, which may be of more local than regional use, and by **Pocknall** for the Waikato Coal Measures of Eocene-Oligocene age in North Island. An extension of this zonation by **Mildenhall** and **Pocknall** into the late Tertiary of Central Otago (South Island) is underway. Although thick Tertiary sequences exist, terrestrial beds are relatively rare, and high rates of sedimentation usually make palynomorph recovery from marine rocks unrewarding. Tertiary dinoflagellates are being studied by **Wilson** and **Wright** is studying Paleocene dinoflagellates.

Quaternary: Quaternary palynomorphs have recently been or are currently being studied at Auckland, Massey, Victoria, Canterbury and Otago universities, Botany Division, and NZGS. While thick marine sequences of middle and early Quaternary age exist, most work is concentrated on sequences of Holocene and Last Glaciation age, especially peat sequences associated with dated tephtras. The most concentrated work is done at Botany Division, DSIR (**N.T. Moar**, who recently retired, and **M.S. McGlone**). Numerous pollen diagrams have been published based on pollen analyses over most of New Zealand, its offshore islands and some sub-Antarctic Islands. **Moar** has tended to specialise on the glacial/interglacial sequences of South Island, while **McGlone** has studied peat sequences associated with dated tephtras in North Island. Quaternary work at NZGS is associated either with isolated sites of geological interest or with thick, usually marine, early to middle Quaternary sequences. At Massey University **C. Lees** recently completed her pollen analyses of northern Ruahine Range (North Island) bogs, and late Holocene sequences on Mt. Egmont. At Victoria University **M. McLea** is studying glacial/post-gla-

cial sequences at the foot of the Tararua Ranges (southern North Island). At Auckland University **R. Newnham** is studying late Quaternary cores from a number of northern North Island sites to trace post-glacial vegetational development. **D. Murray** has completed his work on an early Quaternary lake sequence at North Kaipara Barrier, northern North Island. At ANU, **R. Bussell** is studying New Zealand Quaternary terrace sequences from the Wanganui area (North Island) in association with **B. Pillans** (Victoria University) using pollen analysis, amino acid dating and tephrochronology. At AU **M. Steel** has completed a detailed study on Ruapehu (North Island) on the effects of the Taupo eruption (1800 BP).

Archeology: Pollen analysis at AU by **Newnham** partly concerns the arrival and impact of man on northern North Island vegetation, while **D. Sutton** works on identifying dates of first settlement of New Zealand and central-east Polynesia by reconstructing anthropogenic impact on vegetation and landscape. **P. Chester** (AU) recently completed her thesis on forest clearance in the Bay of Islands (northern North Island) and is currently preparing a computer key for the identification of pollen and spores of native New Zealand plants. **McGlone** and **Steel** are working on deforestation sequences in central North Island.

Modern Pollen Rain and Pollen Morphology: Relatively few studies on the modern pollen rain have taken place or have been published, which limits detailed discussion on some of the Quaternary sequences already analysed. Recent detailed work on surface samples by **Moar**, **McGlone** and co-workers of Botany Division, in association with the Climatic Research Unit of the University of East Anglia (Britain), has resulted in the publication of a quantitative analysis of modern pollen-climate relationships in New Zealand indigenous forests based on a compilation from numerous sources of arboreal pollen data from 161 sites throughout New Zealand. Other studies have been done in association with pollen analyses of local Quaternary peats.

Spore/pollen morphological studies have been restricted to a very small number of taxa. This field is wide open for further work. **F.B.**

Sampson (Victoria University), in collaboration with **D.B. Foreman** (National Herbarium, Victoria), has as his main research project the study of the pollen morphology of the Monimiaceae *sensu lato*. His recent published work has centered around pollen morphology and development within the Winteraceae and Trimeniaceae. **M.F. Large** (AU) is currently revising **W.F. Harris's** classic bulletin on the fern spores of New Zealand. Botany Division (**Moar**) is currently preparing an atlas of modern New Zealand dicotyledonous pollen types. A number of other recent papers by **Pocknall**, some co-authored with American specialists, have been published on the pollen morphology of *Beauprea*, *Epilobium* and *Fuchsia*. Spore morphology of the Anthocerotales is being studied by **E.O. Campbell** (Massey University).

D.A. Burns (Oceanographic Institute) and co-workers have worked on modern dinoflagellate cysts (*Ceratium*, *Gonyaulax*) found in New Zealand coastal waters.

Other Palynological Activities: Occasional forensic palynological analyses are carried out by Botany Division and NZGS.

Melissopalynology is carried out at Botany Division. **Moar** has established the basis for quality control of honey, works with food exporters to this end, and helps local apiarists so that they can monitor the quality of their own honey, and meet the requirement of a microscopical examination sometimes required by importing countries.

Overseas: A number of New Zealand palynologists are currently working on material collected overseas, or working in conjunction with overseas palynologists. **Mildenhall** and **Wilson** (NZGS) are working on Oligocene-early Miocene sediments from the CIROS-1 drillhole in McMurdo Sound, Antarctica. **Pocknall** (NZGS) is completing the work he did with colleagues at US Geological Survey on Paleocene-Eocene palynology of the Powder River Basin (Wyoming/Montana). **Wilson** has recently published data on the circum-Pacific occurrence of the Late Triassic dinoflagellate *Sverdrupiella*, in association with **Helby** and **V.D. Wiggins** (Chevron, USA). **Grant-Mackie** and **de Jersey** are studying Permian-Jurassic sequences in New Caledonia. **Helby** is studying

dinoflagellates in Mesozoic rocks from Misool, Indonesia, and in Upper Jurassic-Lower Cretaceous rocks from southern Tibet, assisted by **F. Hasi-buan** and **Li Xiaochi** (AU). **Pocknall** is preparing a catalogue of fossil *Nothofagus* pollen with **M. Dettmann** (Brisbane) and **E. Romero** (Buenos Aires).

Consultants: Currently in New Zealand only one private enterprise company offers palynological services.

7TH IPC UPDATE

Preparations for 7 IPC are now well advanced. Based on the encouraging number of responses to the First Circular, there is every expectation that the Congress and its attendant excursion programme will be an outstanding success.

The Second Circular has now been distributed and Congress registration/field trip bookings may be made on the registration form enclosed therein.* Although the deadline for payment of advance registration and excursion deposits is 28th June, 1988, persons particularly interested in any of the listed excursions are advised to register/book as early as possible. This may prevent disappointment, as the number of places on each excursion is limited. Moreover, 7 IPC has to compete with World Expo '88 and the Australian Bicentennial celebrations for accommodation and other tourist-related services. Consequently, some excursions, notably those running to popular tourist areas, may have to be cancelled, unless their financial viability can be established at a stage early enough to secure (by payment of deposits) the tentative bookings already made for accommodation, transport, etc.

All enquiries should be addressed to:

7 IPC,
UniQuest Ltd.
University of Queensland,
ST LUCIA, QLD 4067
AUSTRALIA

Telex: AA40315 UNIQLD
Telephone: (07) 377 2733
International: 61-7-377 2733

*There is an error in the registration form—Post-Congress Excursion LB5 should say "Heron Island" (not "Hunter Valley"), in conformity with the text in the 2nd Circular.

110-1988

FUTURE MEETINGS OF INTEREST TO PALYNOLOGISTS

January 21, 1988

OFFSHORE S.E. ASIA, (7th Conference and Exhibition), Singapore. (D.H. Morgan, SEAPEX Program Committee, Southeast Asia Petroleum Exploration Society, P.O. Box 423, Tanglin P.O., Singapore 9124)

January 31-February 5, 1988

ACHIEVEMENTS IN AUSTRALIAN GEO-SCIENCE (9th Australian Geological Convention), Brisbane, Australia. (Dr. G.W. Hoffman, Geological Survey of Queensland, GPO Box 194, Brisbane, Queensland 4001, Australia)

March 13-16, 1988

PETROLEUM EXPLORATION OF THE SUBANDEAN BASINS (III Simposio Bolivariano), Caracas, Venezuela. Languages: Spanish and English. (III Simposio Bolivariano-Cuencas Subandinas, Apartado Postal 65682, Santa Paula, Caracas 1066-A, Venezuela)

March 20-23, 1988

AAPG/SEMP (Annual Meeting), Houston, Texas, U.S.A. (Convention Department AAPG, Box 979, Tulsa, OK 74101, U.S.A.)

April 19-23, 1988

INTERNATIONAL SYMPOSIUM ON CIRCUM-MEDITERRANEAN PALYNOLOGY, Zeist, The Netherlands. Co-Sponsored by CIMP and the Laboratory of Palaeobotany & Palynology, University of Utrecht. (Secretariat, Symposium on C-M. Palynology, Lab. of Palaeobotany & Palynology, Heidelberglaan 2, 3584 CS Utrecht, The Netherlands).

May 11-12, 1988

CLASSIC PETROLEUM PROVINCES (Geological Society Meeting), London, U.K. (Dr. J.S. Brooks, 10 Langside Drive, Newlands, Glasgow G43 2EE, Scotland, U.K.)

May 24-25, 1988

ORIGINS AND EVOLUTION OF THE ANTARCTIC BIOTA, London, U.K., Co-sponsored by Geological Society of London and Palaeontological Association. (J.A. Crame, British Antarctic Survey, High Cross, Madingley Road, Cambridge CB3 0ET, U.K.)

July 18-22, 1988

GONDWANA (7th International Symposium), Sao Paulo, Brazil. Co-sponsored by IUGS, (A.C. Rocha-Campos, Instituto de Geociencias, Universidade de Sao Paulo, C.P. 20899, Sao Paulo, SP, Brazil)

August 14-21, 1988

PEAT (8th International Congress), Leningrad, U.S.S.R. (Peat Congress, Ministry of Fuel Industry of the RSFSR, Sadovaya-Chernogryazskaya 8, Moscow 107813, U.S.S.R.)

August 20-27, 1988

INTERNATIONAL PALAEOBOTANICAL CONGRESS (3rd), Melbourne, Australia. (Secretary, 3rd IOP Conference, P.O. Box 1901R, G.P.O., Melbourne, Victoria 3001, Australia)

August 28-September 2, 1988

INTERNATIONAL PALYNOLOGICAL CONGRESS (7th), Brisbane, Australia. (7 IPC, Uniquet Ltd., Univ. Queensland, St. Lucia 4067, Australia)

September 14-16, 1988

SEQUENCES, STRATIGRAPHY AND SEDIMENTOLOGY: SURFACE AND SUB-SURFACE (CSPG Conference), Calgary, Alberta, Canada. (Dale Leckie, Geological Survey of Canada, 3303-33rd Street NW, Calgary, Alberta, Canada T2P 0H6)

October 1988

COAL RESEARCH (International Conference), Tokyo, Japan. (Dr. W.G. Jensen, International Committee for Coal Research, Bte 11, B-1150 Brussels, Belgium)

October 3-5, 1988

CORRELATION IN HYDROCARBON EXPLORATION (Meeting), Bergen, Norway. (Norwegian Petroleum Society, P.O. Box 1897 - Vika, N-0124 Oslo 1, Norway)

NEW BOOKS

MANGROVE PALYNOLOGY by **G. Thanikaimoni**; 100 p., 20 figs. & 4 pls., 1987. *Institut Francais de Pondichery*, P. B. 33, Pondicherry 605001, India. Price: 250 Ff. (ca. US\$40).

A copy of this attractive and informative publication was recently sent to me from Pondicherry by the last President of ICP (1980-84), Dr. Claude Caratini, who is currently on a 2-yr. leave of absence from CEGET, Talence (France) in order to complete a number of palynological research projects initiated by Dr. G. Thanikaimoni that had been halted by Thani's tragic and untimely death (*Palynos* 9, No. 2, pp. 2-3, Dec. 1986). The final manuscript of *Mangrove Palynology* was completed by Drs. Caratini, C. Tissot and Mrs. K. Thanikaimoni from Thani's copious notes, keys and photomicrographs of both recent and fossil palynomorphs found in mangrove ecosystems (an UNESCO-sponsored research project).

PALYNOLOGY IN THE USSR. **A.F. Chlonova** (editor); 180 p., 21 figs., 10 tables & 32 plates, 1988. "Nauka", Siberian Branch, Novosibirsk, USSR. Tentative price: 3 rubles.

Dr. Chlonova (an IFPS Vice-Pres.) reports that this volume has been specially prepared for the 7th IPC. It contains the details of the principal trends of both actuo- and paleopalynology developing in the Soviet Union. This publication will be distributed by the *v/o Mezhdunarodnaya kniga* (Moscow 113095, USSR). Contact either Dr. Chlonova or me for a list of book dealers in your country having business relations with this Moscow firm.



Brisbane!

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James E. Canright
Department of Botany
Arizona State University
Tempe, Arizona 85287 U.S.A.
(602) 965-1762



Season's Greetings

701542
Arizona State University
Department of Botany
Palynology Laboratory
Tempe, Arizona 85287

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