

30/1971

THE AUSTRALIAN NATIONAL UNIVERSITYRESEARCH SCHOOL OF PACIFIC STUDIESDEPARTMENT OF BIOGEOGRAPHY AND GEOMORPHOLOGYANNUAL REPORT 1970StaffProfessor Biogeography  
and Head of Department

D. Walker, B.Sc.(Sheff.), M.A., Ph.D(Cantab.)

Professorial Fellow in  
Geomorphology

J.N. Jennings, M.A.(Cantab.)

Senior Fellow

D.N. McVean, B.Sc.(Glas.), Ph.D.(Cantab.)  
[to 31.8.70]

Fellow

G.Singh, B.Sc., M.Sc.(Punjab), Ph.D.(Lucknow)  
Ph.D.(Belfast) [from 30.6.70]

Honorary Fellow

W.H. Litchfield, B.Sc. Agr.(Syd.)

Research Fellows

J.M. Bowler, B.Sc., M.Sc.(Melb.)

Helena E. Reeve, B.Sc., Ph.D. (Leicester)

B.G. Thom, B.Sc.(Syd.), Ph.D. (Louisiana)  
[from 27.11.70]

Research Assistants

Miryam Glikson, M.Sc.(Jerusalem) \*

Joan C. Guppy, B.Sc.(Adel.) \*

A.P. Kershaw, B.Sc. (U.C.Wales), M.Sc.(Dunelm.)  
[to 24.3.70]

Honor Moore, B.Sc., M.Sc.(Melb.) \*

Research Scholars

R.J. Coventry, B.Sc.(ANU)

R.J. Hnatiuk, B.Sc., M.Sc.(Alberta)

G.S. Hope, B.Sc., M.Sc.(Melb.)

A.P. Kershaw, B.Sc.(U.C.Wales), M.Sc.(Dunelm.)  
[from 25.3.70]I. Noy-Meir, B.Sc., M.Sc.(Jerusalem)  
[to 17.10.70]

C.F. Pain, B.A., M.A.(Auckland) [from 2.3.70]

Jocelyn M. Powell, B.Sc., M.Sc. (Auckland)  
[to 6.5.70]

J.I. Raine, B.Sc.(ANU)

J.M. Urquhart, B.Sc., M.A.(Toronto)

C.R. Whitaker, B.A. (Cantab.) [from 21.9.70]

Technical Officers

K. Fitchett

W.E. Hocking [from 31.8.70]

R.A. McDonnell

Laboratory Technicians

Victoria Glass \* [from 16.6.70]

Patrice Goncz

D. James

Dianne Lockie \* [to 16.4.70]

Patricia Mudge \* (CSIRO Herbarium)

Rosemary B. McKenna \*

Margaret Ramsay \*

\* Part-time appointments



Laboratory Attendant	Constance J. Thompson
Departmental Secretary	Elizabeth A. Malin [to 25.11.70]
Typist	Doris E. Corson

### Visitors

Dr A.B. Costin, Assistant Chief of the Division of Plant Industry, CSIRO, continued as Honorary Visiting Fellow in the Department until 31.8.70. Mr J.B. Firman, Senior Geologist, South Australian Department of Mines, was a Visiting Research Fellow from 9.2.70 to 12.6.70. Dr Eilif Dahl, Professor of Botany, Agricultural College of Norway at Vollebekk, was Visiting Fellow for nearly the whole year (17.1.70 to 14.12.70) and Dr P.J. Grubb, Lecturer in the School of Botany at Cambridge University, began a visit as Honorary Visiting Fellow on 13.10.70. In addition the Department benefited from short visits from the following:

- Dr J. Conolly, University of South Carolina, U.S.A.
- Dr C.H. Hendy, Institute of Nuclear Sciences, New Zealand
- Mr D. Lowry, Geological Survey of Western Australia
- Dr N.P. Perera, Vidyodaya University, Ceylon
- Dr W.T. Stearn, British Museum (Natural History), England
- Dr M. Thomas, University of St Andrews, Scotland
- Dr L.J. Webb, CSIRO, Brisbane.

The facilities of the Mt Wilhelm Field Station, T.P.N.G., were used by the following visitors: Professor Bayliss, University of Otago, N.Z.; Mr Courtney-Smithers, Australian Museum, Sydney; Dr J. Hope, Department of Prehistory, ANU; Dr Y. Kobayasi, Japanese Microbiological Expedition; Mr W.P. Packard, Department of Geography, ANU; Dr I. Staff, Latrobe University; Professor Thornton, Latrobe University; Mr Willis, National Herbarium, Melbourne. Mr C. Bell, University of Queensland, made use of the Departmental pollen collections during a brief stay in Canberra.

### The Role of the Department

Certain aspects of the natural environment of man in Australasia, the southwest Pacific and southeast Asia constitute the field of study of the Department. These are notably the landforms and their vegetative cover, though occasionally other aspects such as climate may be investigated where special circumstances prompt this. Though regionally based, these interests are generally pursued with systematic questions in mind.

A major biogeographical field lies in the sociology and ecology of plant communities, including quantitative and productivity approaches, so far centred on mountain communities and the Australian mallee. Studies of secondary plant successions provide links with the Human Geography and Anthropology Departments. The geographical distribution of plant taxa, including lichens and mosses, within the region specified provides another interest and some work is proceeding on lifeforms. Greatest effort has gone so far into vegetation history through palynology and this Quaternary research has forged the closest links with the Department's landform studies and has also led to close association with the Prehistory Department.



Within geomorphology, emphasis has been placed on the Quaternary evolution of landforms and in this direction the stratigraphy and sedimentology of superficial deposits is a vital tool, complementary to the palynological work of the Department and allied to the activities of the Prehistory Department. Morphometric analysis and modern process studies are also pursued, which are expected to link up with the Department's investigations of modern vegetation. Of landform categories, coasts, karst (including caves) and lakes have received most attention, but fluvial and slope researches are also carried on.

Some of the research has an applied as well as fundamental value and there is active concern with conservation. Opportunities for participation in practical problems of the wise use of environments and natural resources are taken up to a degree consistent with the prime scientific aims of the Department.

#### Personalia

Professor Walker was Acting Director of the Research School of Pacific Studies from 12 September to 22 October. He returned from study leave in New Zealand on 28 January and went to England for six months' leave on 17 November. Mr Jennings was Acting Head of the Department in his absences.

Dr D.N. McVean resigned his Senior Fellowship in August to return to Scotland and to take up the profession, still rather novel, of ecological consultant. An offer of the vacated post was made in late December. Dr Gurdip Singh joined the Department as Fellow on the palynological side in June from the Birbal Sahni Institute of Palaeobotany, India. Dr H. Reeve was granted three months' leave of absence without pay for private reasons and left for England on 5 December. Mr W.H. Litchfield returned on 25 June from a year's study leave based on the Laboratoire de Palynologie at the University of Montpellier, France.

A newly created Fellowship in geomorphology with special responsibility for the sedimentological aspect was offered to Mr J.M. Bowler, Research Fellow, and it is expected that he will take up this permanent appointment early in 1971. An offer of the Research Fellowship which thus falls vacant was made in late December. On 27 November, Dr B.G. Thom, Director of the McGill University Subarctic Research Station at Schefferville, Labrador, returned to the warmer climes of his native country to take up a previously vacated Research Fellowship in geomorphology.

Mr A.P. Kershaw was translated from Research Assistant to Research Scholar within the Department, and two new research students joined, one from New Zealand and one from England. Two students left the Department, submitting their theses. Four theses in all were submitted during the year but were still in process of examination at its close.



## Research

The dominance of Quaternary research continued this year as was predicted in the last report. Mr J.M. Bowler was mainly concerned with putting into thesis form the major part of his substantial findings on the late Quaternary history of selected lakes in southeastern Australia, but he also excavated with Professor N.W.G. Macintosh of Sydney University an aboriginal skeleton wearing a remarkable necklace of Sarcophilus teeth from a lunette of L. Nitchie near the R. Darling. Preliminary papers on this and on the earlier Mungo Man discovery were published during the year. During his stay in the Department, Mr J. Firman synthesised available Quaternary stratigraphic and geomorphic data from the Lower Murray province of South Australia for a memoir. Mr R.J. Coventry completed fieldwork on Lake George shorelines, experimented with methods of separating charcoal from soil for C-14 dating, prepared his own samples for dating and began other laboratory work. He found congruence between shoreline sequences at the northern and southern ends of the lake; the highest beaches formed when the lake was 120 feet deep and overflowed through Geary's Gap at the time of the last glacial maximum. A former scholar, Mr R.M. Frank, submitted his Ph.D. thesis on the morphology and sediments of selected cave systems in eastern New South Wales. A limited amount of paleoclimatic reconstruction proved possible and light was thrown on particular systematic aspects of cave excavation and deposition. Dr Costin prepared earlier work on periglacial slope deposits in the Snowy Mountain for publication.

Mr Jennings carried out further field work during June to August on the Fitzroy R. estuary, W. Kimberley, assisted by Mr Coventry as temporary Research Assistant and by Mr K. Fitchett, Technical Officer. Parts of the programme were not successful because of various practical difficulties, (for instance, Mr Fitchett had to walk 21 miles in high temperatures to the nearest road when five simultaneous flat tyres with numerous punctures used up all repair patches). However the stratigraphy of Flandrian estuarine transgression into an older desert dunefield established previously was confirmed and elaborated. Desert dune sands were traced nearly 50 feet below HWM and a phase of pedogenesis proven, following the maximum of the transgression and preceding a modest aeolian phase of dune sand redistribution. The structure of a barrier island was determined and the continued mobility of other barrier islands within a mangrove swamp belt is a discovery of systematic significance not known to have been recorded elsewhere.

Mr C.F. Pain began a study of the landforms and soils of the Kaugel valley in the Highlands of New Guinea which will necessarily have a marked historical content. This is the Department's first Ph.D. investigation in geomorphology of a New Guinea area.

Further progress has been made on the Late Quaternary vegetation history of the New Guinea Highlands. Mrs J.M. Powell (née Wheeler) submitted her Ph.D. thesis on the pollen analysis of swamps in the Mt Hagen area, revealing anthropogenic influences over a probable period of 5000 years. Mr Hope has completed



field work on the lake deposits of Mt Wilhelm and has begun pollen analyses to determine vegetation history since deglaciation, which has lasted at least 10,700 years at 14,400 feet on the basis of a single C-14 date determined so far. Mrs J. Guppy continues analysis of Professor Walker's long sequence of lake muds from Sirunki. In conjunction with Dr R. Hoogland of the Research School of Biological Sciences, Dr A.B. Costin prepared certain paleobotanical data from the Sarwaket Plateau for publication.

Mr A.P. Kershaw has continued research into the vegetation history of the Atherton Tableland. Results now published from Lake Euramoo have been paralleled by those from Quincan crater nearby and together they indicate a regional pattern of dry land vegetation changes controlled predominantly by climate. Material from two other crater lakes has been collected and analysis is proceeding. On reconnaissance journeys in the interior of Australia Dr Gurdip Singh has examined a number of lakes in the arid and semi-arid zones and found their sediments to contain enough pollen to warrant beginning a long-term investigation of their Late Quaternary vegetation history, initially in the southeastern quadrant. The potential for conclusions about climatic history complementary to those of Mr Bowler seems good and promises well for further underpinning of our dawning understanding of the late paleogeography of this part of the continent.

A necessary preliminary for Dr Singh is to investigate the present day pollen rain and therefore twelve pollen trapping stations have been set up down the rainfall gradient in southern N.S.W. and northwestern Victoria for annual counts over a number of years. This study will not only be necessary for interpreting fossil pollen records but should throw fresh light on pollen dispersal mechanisms. Meanwhile Mr Raine has progressed with his studies of pollen rain in the Snowy Mountains and pollen sedimentation in Blue Lake there. Relevant meteorological instruments have been set up and the bathymetry of the lake pursued. Mr Litchfield has resumed his work on the palynology of mineral soils of the 'brigalow' of southern Queensland at new sites. Surface samples show the effects of modern clearance and give confidence in interpretation of both recent vegetation changes and possible recent soil churning in gilgai terrain from the soil pollen record. Allied pollen trapping and 'tracer' pollen experiments continue.

The computer assisted identification programme for pollen has been made more versatile and there has been a steady increase in the bank of stored reference descriptions through the work of Mrs H. Moore and Mrs M. Glikson. The first paper from an examination of computer analysis of pollen sequences by Professor Walker and Dr M.B. Dale, CSIRO, appeared during the year. Mrs Guppy carried out serological work on guinea pigs, using fresh, whole Acacia and Callistemon pollen, to test specificity of pollen antigens but the results were inconclusive owing to the unsuspected unsuitability of bacteriostatic merthiolate for the experiments and the extreme sensitivity of the subjects manifest in the skin tests. Mrs Guppy also experimented with electron microscope stereoscanning



of pollen exines coated with gold in a Dynavac machine. Specific separation in Casuarina proved impossible and Gramineae are now being explored with this technique.

Prior to leaving the Department, Dr McVean completed his analysis of the unfortunately disjointed meteorological data so far obtained from Mt Wilhelm. This waits on Dr J. Peterson's study of the glacial geomorphology of the mountain, which is in progress, to appear together as a further item in the Mt Wilhelm series in the Departmental Publications. The instruments have been maintained in operation by Mr R. Hnatiuk, Research Scholar and Mr Wayne Hocking, a newly appointed Technical Officer.

During March to October, Mr Hnatiuk measured the primary productivity of subalpine and alpine tussock grassland on Mt Wilhelm. Plans for comparative work on Macquarie Island fell through for logistic reasons but a start was made in the Snowy Mountains as an alternative area and a third possibility of another southern island is being explored. Mr I. Noy-Meir completed his Ph.D. research into certain methods of quantitative plant ecological analysis applied to his western N.S.W. data and submitted his thesis.

Dr H. Reeve extended her study of pachycauly with particular attention to frond bases; some comparison has been made between the structure and longevity of pachycaul fronds and leptocaul leaves. An account of intergeneric leaf shape parallelism in Proteaceae is nearly completed.

Dr J. Hope, Honorary Research Assistant in 1969, now of the Prehistory Department, is still engaged in the preparation and identification of mammals collected in her fauna survey of Mt Wilhelm. Professor Eilif Dahl cooperated with Dr Costin and Mr E. Pook, CSIRO, in a project to measure lethal temperatures of Australian plants, especially eucalypts, and to relate these to morphology, distribution and habitat preferences. This involved preparation of a map of annual maximum temperatures in the continent and the devising of methods of measuring diffusion resistance to water vapour and coefficients of heat exchange of leaves. Dr P. Grubb began his study of productivity of certain montane rainforest communities at different altitudes in the Highlands near Goroka in New Guinea.

Mr Jennings continued long-term observations of present day snow patch action on Mt Twynam, Snowy Mountains. Dr Costin and he gave a seminar on further results from this work, some of them interim but the determinations of snow stress at the rock interface have been prepared for publication. With R.A.A.F. helicopter help, they examined evidence of similar action on a southern A.C.T. summit; this occurrence seems indubitable but anomalous in altitude and aspect.

Mr Jennings made measurements of minor granite landforms of novel type on Wudinna Hill, Eyre Peninsula; a joint paper with Dr C.R. Twidale, Adelaide University, has been accepted for publication. He continued local karst studies on Cooleman Plain and at Bungonia. A paper on a relict outflow cave system on Cooleman Plain is in preparation. On Cooleman Plain further instruments have



been brought into operation for the hydrometeorological aspect of a karst denudation rate study.

At the beginning of the year, the Festschrift for Professor H. Godwin of Cambridge University on his retirement, of which Professor Walker was one of the editors and to which he contributed, was published by the Cambridge University Press. Both Professor Walker and Mr Jennings worked under Professor Godwin at Cambridge in times past and he was a Visitor to the old Department of Geography a few years ago.

During the year Mr Jennings edited a further volume in the Systematic Geomorphology series for the ANU Press and also handed the manuscript of his own volume on karst in this series to the Press. He resumed editorship of the Australian Landform Examples series in the Australian Geographer which he initiated.

Whilst on a visit to New Guinea to advise Mr Pain, Mr Bowler visited Madang to make preliminary observations of the geomorphic effects of the 7.1 magnitude earthquake experienced near there this year. It is hoped to document them more fully and promptly than has happened previously, perhaps with the help of colour aerial photography if funds can be found; this would have considerable practical as well as scientific value. Dr B.G. Thom resumed earlier work on the coastal geomorphology of N.S.W. immediately on joining the Departmental staff. In pursuit of his Ph.D. study of river channel morphology in relation to sediments and flow regime on the River Murray, Mr Urquhart chiefly conducted cartographic and computer analyses during the year but also carried out preliminary field work. Spectral analysis of river pattern did not yield as well as might have been expected and for comparison a computer programme to apply the Ongley method of meander analysis was prepared. Flow deviation analysis of River Murray gauging stations showed that there is no simple downstream trend in bankfull discharge and as might be expected bankfull discharge downstream of the Hume Reservoir has decreased since its construction. Mr Whitaker has been executing various preliminary tasks in preparation for a study of pediment morphology in the Kimberleys, which will pursue in particular a comparison of variation with lithology.

The testing of the newly acquired Mackereth lake sediment corer was the occasion of a gathering of a large number of members of the Department at Burrill Lake, N.S.W. Excellent cooperation by boat and land parties ensured a successful trial despite execrable atmospheric conditions.

#### Seminars

Professor Walker and Mr Jennings gave a series of seven lectures to the non-academic staff on the work of the Department against the outlined context of the disciplines concerned. Professor Dahl gave a twelve hour course on the identification of Australian macro-lichens in the ANU Botany Department open to all interested Canberra botanists. Twelve Departmental seminars of the work-in-progress kind and by visiting scientists were held. The Quaternary Discussion Group was active during the year, 20 papers being presented and discussed.



On several occasions related papers were grouped into joint sessions and the final occasion was a successful small symposium on the origin and Quaternary environments of desert regions.

#### Conferences and outside activities

Professor Walker continued as member of the Australian National Committee for Quaternary Research and of the Pacific Science Association's Standing Committee for Botany, and as convener chairman of the I.B.P. Working Committee on Air Spora. He was President of the Botany Section of ANZAAS at the Port Moresby Congress where he surveyed in his address the results of the Department's researches thus far on the vegetation history of the New Guinea Highlands, stressing the bearing it has for the human history there.

Five other members of the Department - Professor Dahl, Mrs. Powell, Messrs Hnatiuk, Hope and Pain also attended ANZAAS. Mrs Powell and Mr Pain presented papers. Messrs Jennings, Bowler, Coventry and Whitaker attended the Third Sedimentology Specialists Conference of the Geological Society of Australia held in Canberra in November. Mr Coventry led an excursion to the Lake George area. He also helped to organise a weekend's field work in this area for Earth Science undergraduates from Macquarie University.

During his New Zealand study leave, Professor Walker familiarised himself with progress in ecological work there in connection with a book on vegetation dynamics on which he is engaged. He was based at the University of Otago but visited certain other N.Z. university botany and geography departments. Whilst on study leave, Mr Litchfield visited centres of palynological activity at Cambridge, London and Copenhagen apart from his major stay at the laboratory at Montpellier.

Professor Dahl took part in several symposia on conservation problems at various centres. He was invited to lecture to the Royal Society of Canberra on 'Social and Scientific Implications of Modern Conservation', which was also the basis of a submission he made to the House of Representatives Select Committee on Wildlife Conservation. He also lectured in the University of Queensland on vegetation classification and conservation problems. Mr Bowler gave a paper on the age and stratigraphy of the Mungo skeleton at the Canberra conference of the Australian Institute of Aboriginal Studies, to which he was elected a member. He also gave short lecture courses in the School of Earth Sciences, Macquarie University, and the Department of Geology, Melbourne University. Mr Jennings gave a lecture in the experimental Human Biology course at the Canberra College of Advanced Education and his children's book on 'Caves' was completed and published by OUP in the course of the year. Messrs Raine and Urquhart contributed seminars to a series on continental sedimentation in the Geology Department, ANU.

#### Doctorates awarded or recommended

Nil report.



### Acknowledgements

Dr K.A.W. Crook (Department of Geology, SGS), Dr P. Walker (CSIRO) and Dr W.T. Williams (CSIRO) have served as joint supervisors of research students.

Members of the Department have also received valuable help of many kinds from the following individuals and organizations:

Madame Van Campo, Laboratoire de Palynologie, Montpellier.  
 The Director, National Herbarium, Melbourne Botanic Gardens.  
 The Director, National Herbarium, Sydney Botanic Gardens.  
 Dr K. Eldridge, Forest Research Institute, Canberra.  
 Mr K. Johnson, River Murray Commission, Canberra.  
 Mr M. McLeod, River Murray Commission, Canberra.  
 Dr B. Philips, Canberra Botanic Gardens.  
 Mr G. Tracey, CSIRO, Brisbane.  
 Dr L.J. Webb, CSIRO, Brisbane.  
 Mr J. Womersley, Department of Forests, Lae.

Department of Primary Industry, Atherton Office.  
 National Parks and Wildlife Service of N.S.W., Kosciusko National Park.  
 R.A.A.F., Fairbairn.  
 Royal Military College, Duntroon.  
 Snowy Mountains Authority, Cooma.  
 Soil Conservation Service of N.S.W., Cooma Office.  
 State Forestry Office, Atherton.  
 The Herbarium, Brisbane Botanic Gardens.  
 CSIRO Soils Laboratory, Canberra.  
 CSIRO Land Research Division.

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- Butlin, N.G.<sup>‡</sup> and Jennings, J.N. 1970. Introduction. Pages IX-XXIV in Atlas of Bundaleer Plains and Tatala by F.M. Rothery. ANU Press, Canberra.
- Dale, H.B.<sup>‡</sup> and Walker, D. 1970. Information analysis from pollen diagrams I. Pollen et Spores, 12, 21-37.
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- Hope, J.<sup>‡</sup> and Hope, G.S.\*\* 1970. Marsupials caught in pollen traps at Wilsons Promontory. Victorian Naturalist.

\* Former member. Based on work done while a member of the Department.

‡ Not a member of this University

\*\* Based on work done prior to joining this University (a substantial amount of work and compilation having been done at this University).

<sup>‡</sup> Member of the Department of Prehistory.

<sup>‡</sup> Member of the Department of Economic History.



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- Walker D. and West, R.G.<sup>†</sup> (Eds.) 1970. Studies in the Vegetational History of the British Isles. CUP, Cambridge.

† Not a member of this University.

∅ Based on work done while a member of the Department of Geophysics and Geochemistry.

∅ Member of the Department of Prehistory.

\*\* Based on work done prior to joining this University (a substantial amount of work and compilation having been done at this University).