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21/1974

THE AUSTRALIAN NATIONAL UNIVERSITY

RESEARCH SCHOOL OF PACIFIC STUDIES

DEPARTMENT OF BIOGEOGRAPHY AND GEOMORPHOLOGY

ANNUAL REPORT 1973

Academic Staff

Professor of Biogeography and Head of Department	D. Walker, B.Sc.(Sheff.), M.A., Ph.D.(Cantab.)
Professorial Fellow in Geomorphology	J.N.Jennings, M.A., Ph.D.(Cantab.)
Senior Fellow	N.M. Wace, M.A. (Oxon.), Ph.D.(Belfast)
Fellows	G. Singh, B.Sc., M.Sc.(Punjab), Ph.D.(Lucknow), Ph.D. (Belfast)
	J.M. Bowler, B.Sc., M.Sc.(Melb.), Ph.D.(ANU)
Honorary Fellows	W.H. Litchfield, B.Sc.Agr.(Syd.)
	Helena E. Reeve, B.Sc., Ph.D.(Leicester)
Senior Research Fellow	B.G. Thom, B.Sc.(Syd.), Ph.D.(Louisiana)
Research Fellows	R.F. McLean, B.A., M.A.(Canterbury), Ph.D.(Montreal)
	J. Ogden, B.Sc., M.Sc., Ph.D.(Wales) [from 13.12.73]
Research Assistants	Margaret Brock, B.Sc.(ANU)*
	D. Cooke, B.Sc.(Melb.)*
	Miryam Glikson, M.Sc.(Jerusalem)*
	Marietta J. Grubb, B.Sc.(Tas) [from 10.1.73]
	Joan C. Guppy, B.Sc.(Adel.)*
	Daphne Moss, B.Sc.(Reading)*
	G.S. Hope, B.Sc., M.Sc.(Melb.), Ph.D.(ANU) [from 1.7.73]

* Part-time appointments

Visitors

Dr A.B. Costin, CSIRO Division of Plant Industry, completed one period of Honorary Fellowship in April and began another in November. Dr T.M.L. Wigley returned to Waterloo University, Canada, in April after a seven month visit. Dr S.N. Rajaguru of the Deccan College, Poona, arrived for a year in July.

In addition, the Department benefited from short visits from many Australian scientists as well as the following from overseas:

Professor A. Cailleux, Université Laval, Quebec
Dr H. Faure, Bellevue, France
Dr J.R. Flenley, The University, Hull
Professor J. Gjessing, University, Oslo
Professor U. Hafsten, Norges Laererhogskole, Trondheim, Norway
Professor K. Konishi, Kanazawa University, Japan
Dr A. Leroi-Gourhan, Paris
Professor B. Mears, Wyoming, U.S.A.
Professor G.F. Mitchell, Trinity College, Dublin
Dr O. Odak, National Museum, Nairobi
Dr F. Oldfield, University of Papua-New Guinea
Dr H. Roberts, Louisiana State University, Baton Rouge
Professor C.J.J. van Steenis, Flora Malesiana Foundation, Leiden
Dr P.F. Stevens, Arnold Arboretum, Harvard
Dr J. Sournia, Ernée, France
Professor F. Taillefer, University of Toulouse, France.

The role of the Department

Certain aspects of the natural environment of man in Australasia, the southwest Pacific and southeast Asia constitute the Department's field of study. These are principally the landforms and their vegetative cover as they appear at the present day and as they have developed in the past, although other matters, such as climate and hydrology, are investigated where special circumstances prompt this. Problems are chosen for the solution of which the region available for field work is particularly suited.

Many aspects of the Department's work stimulate fruitful cooperation with workers in a variety of disciplines in this and other institutions. This is perhaps best exemplified in relation to the living environments of prehistoric man, the effects of human movements on the spread of plants, the incidence of allergenic particles and the problems of coastal engineering.

Within geomorphology, the active modification of the landscape at the present day, particularly along the coastlines, tropical hillslopes and limestone areas, now receive almost as much attention as do the Quaternary evolution of landforms and the palaeoclimatic implications of stratigraphic phenomena. Similarly the biogeographers are now as concerned with the mechanisms of vegetation change documented in the historical past and observed at the present day as with the longer-term changes of remoter times.

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

Personalia

Professor Walker was on study leave in USA, Great Britain and India from 4 August to 5 September, for which period Dr N.M. Wace was appointed Acting Head of Department.

Dr Jennings spent study leave from 17 August to 7 October in Germany, Austria, Hungary, Yugoslavia and Czechoslovakia and was awarded a medal for his contributions to speleology by the Palacky University of Olomouc. Dr Singh was in India on study leave from 10 March to 21 June.

Dr Hope undertook a private tour of Quaternary research laboratories in U.S.A., Britain and Europe from March to June.

Dr Thom was promoted from Research Fellow to Senior Research Fellow during the year and Dr Ogden, formerly Lecturer at Massey University, took up a Research Fellowship in December. Four Research Scholars left the Department: Dr Coventry to a post as Research Scientist at CSIRO Townsville, Mr Kershaw to a lectureship in the Geography Department of Monash University, Dr Pain to a job as Research Scientist in DSIR, New Zealand and Mr Urquhart to a temporary lectureship at York University, Canada.

Research

The year has seen the consolidation of projects already begun and the continuation of long-term recording rather than the initiation of major new lines of research. Most members of the Department have spent considerable periods in the field.

In Quaternary research, Drs Bowler and Rajaguru, in association with Professor D.J. Mulvaney (Department of Prehistory and Anthropology), have carried out extensive field and laboratory work aimed at extending and refining our knowledge of the environment in which Australia's oldest known human occupation flourished near Lake Mungo in western N.S.W. A reconnaissance visit to Lake Frome was facilitated by the Bureau of Mineral Resources and will be followed by more detailed work so as to integrate the Quaternary history of this site with what has already been established by Dr Bowler for lakes further east and in Western Australia.

Along the coast of New South Wales and on the coral islands of the Great Barrier Reef, Dr Thom has continued his stratigraphic investigations with a view to establishing the history of sea-level change and of the construction of coastal features. His discovery of corals beneath Pleistocene coastal sediments in the Myall Lakes region will enable a more specific definition of the age and climatic implications of them than previously thought possible.

Lake George, close by Canberra, has provided materials for sedimentological and palynological studies by Drs Bowler and Singh respectively. The latter has also exposed very promising new sources for the pollen-analytical investigation of vegetation history by establishing that sites close behind the coastal mountains of southern N.S.W. (e.g. Wingecarribee Swamp, Nimmitabel Swamp) contain organic deposits as much as 15,000 years old. Elsewhere on the continent, Mr Dodson has continued to collect data from deposits in southern South Australia which carry the vegetation record back beyond 10,000 years before present and Mr Kershaw has obtained a core from Lynch's Crater in North Queensland which is expected to provide a continuous pollen diagram through the last 200,000 years and which still has not penetrated all the organic mud there. Studies of the vegetation history of the New Guinea Highlands have continued and the accumulated data are now ripe for synthesis into an account covering the last 30,000 years; this is being further developed by Dr Hope's investigations of Mt Carstensz and Mt Giluwe and by Professor Walker and Mrs Guppy's attempts to obtain older materials from their Sirunki site.

Data relating the pollen production of vegetation to that which is recoverable from mud and peat deposits and the systematic accumulation of morphological descriptions which facilitate the identification of pollen grains are endless and laborious tasks which continue to demand substantial

proportions of the time and energy of academic staff and their assistants alike. By contrast with these essential but not immediately rewarding tasks, the development of numerical methods for the analysis of pollen analytical results, which form the penultimate stage in the elucidation of a vegetation history, provides a stimulating field for the more immediate satisfaction of ingenious intellects.

Today's vegetation and landforms are largely the inheritance of the events of the Quaternary period, many of the material processes of which continue now. This connection is well expressed in the Department's work on coastal phenomena, to the Quaternary component of which reference has already been made and both aspects of which were well served by the participation of Drs McLean and Thom and the Department's drilling team in the Royal Society of London-Queensland Universities' Expedition to the Great Barrier Reef. The balancing aspects are provided by Dr McLean's work on the recent evolution of barrier reef islands, his sustained observation of the rates of beachrock erosion on the Queensland coast and the long-term recording of beach and off-shore processes in southern N.S.W. which he has continued with Dr Thom and which has been extended by Mr Bryant. Dr Costin bridges the two periods, Quaternary and present, in his studies of vegetational and environmental change in upland Australia. His establishment of the nature of major climatic events of the past 35,000 years there and the responses of vegetation and soils to them is matched by his studies of the effects of cold climates at the highest altitudes at the present day. He has also monitored the effects of removing grazing animals from the high mountains since 1958 and has distinguished these from the results of naturally occurring hazards such as the droughts of the late 1960s. The effects of rare, catastrophic, events on the long-term geomorphic development of a region can only be studied by taking advantage of them whenever and wherever they occur. For this reason Dr McLean, in association with Dr Baines and Mr Beveridge of the University of South Pacific, is following the movements and modification of a massive storm beach formed off Funafuti Atoll, Gilbert and Ellice Islands, by a cyclone in October 1972.

Dr Wace's work on the historical ecology of plants naturalized in Australia continues through its data-collecting phase. This has been relieved somewhat by his study of the car-borne flora of Canberra, the main technique of which is the germination and identification of plants recovered from the sludge and other debris of a Canberra car-wash; more than 100 species have been obtained so far. Mr Smith completed his work on the origins and ecology of the non-forest flora of Mt Wilhelm, New Guinea, having found that the more recent immigrants show better dispersal and colonising capacity, more rapid growth rates and less precise adaptation to the ecological niches available than do the more anciently established plants. He has also prepared for publication a study of the vexed question of the status, dynamics and nomenclature of New Guinea's mountain grasslands.

Dr Jennings has continued his investigations of limestone erosion by sustained recording on the Cooleman Plain and above and below ground survey at Bungonia, both in N.S.W. At Cooleman, too, the effects of former periglacial conditions on the stability of slope deposits has been demonstrated whilst, on Mt Kosciusko, he and Dr Costin continue to record the geomorphic effects of existing snow beds.

Dr Pain completed his study of the Quaternary fills of the Kaugel Valley in New Guinea and Mr Whitaker the analysis of his data on pediment development in the East Kimberleys (W.A.). Dr McLean and Dr Bowler have been concerned with the elucidation of the stratigraphy of

archaeological sites. Dr Reeve has virtually completed her study of plants used by the people at Nangalala in Arnhem Land. Dr Wace has made further progress with his Floras of the Nuyts Islands and of Tristan da Cunha; Mr Nelson has completed the collection of field data toward the taxonomic revision and geography of the proteaceous genus Adenanthos.

Much of the research of the Department rests heavily on the development of equipment and techniques by its own technical and academic staff. During the year, improvements in earth drilling, the appropriate use of various emulsions in aerial photography and the fabrication of equipment for sedimentological analysis have been amongst the more notable successes.

About 20 seminars were delivered in the Department during the year by its members and visitors in addition to contributions to the Quaternary Discussion Group this year organized by Dr Thom.

Outside activities

This year members of the Department have been more than usually involved with activities beyond its walls.

Professor Walker delivered a lecture to the First International Congress on Systematic and Evolutionary Biology in Boulder and Dr Jennings two papers at the Sixth International Speleological Congress at Olomouc where he also chaired a session. The Ninth Congress of the International Union for Quaternary Research at Christchurch, New Zealand, provided occasions at which 7 members of the Department delivered papers, 3 acted as session chairmen and 3 as excursion leaders. Mr Smith presented a paper to the Third International Gondwana Symposium in Canberra and Drs Thom and McLean similarly contributed to the Second International Symposium on Coral Reefs held off the Queensland coast.

Dr Bowler and Mr Nelson attended the ANZAAS meeting in Perth where the former read a paper and chaired a symposium. Dr Jennings gave his Presidential Address to the Australian Institute of Geographers in February.

At home and overseas, members of the Department have lectured before the following societies and institutions:

Ahmedabad: Physical Research Laboratory (Singh)
Bombay: Tata Institute for Fundamental Research (Singh)
Boulder: Institute for Arctic and Alpine Research, University of Colorado (Hope)
Calcutta: Bose Research Institute (Walker)
Calcutta: Botanical Society of Bengal (Walker)
Cambridge (Mass): Harvard University, School of Biological Sciences (Hope)
Canberra: The First National Conservation Study Conference organized by the Australian Conservation Foundation (Wace)
Canberra: ANU Department of Botany (Singh)
Canberra: ANU Centre for Continuing Education (Jennings)
Canberra: Bureau of Mineral Resources, short course on sedimentology (Thom)
Durham (N.C.): Duke University, Zoology Department (Hope)
Honolulu: B.P. Bishop Museum (Hope)
Hull: Hull University, Department of Geography (Hope)

Jindabyne: Kosciusko National Park, conference on research in progress (Jennings, Raine, Wace)
Kensington (N.S.W.): University of New South Wales, School of Zoology(Jennings)
Leiden: Rijksherbarium (Hope)
London: London University Institute for Archaeology (Hope)
Lucknow: Birbal Sahni Institute of Palaeobotany (Singh)
Melbourne: Victorian Quaternary Group (Raine)
Melbourne: Weed Science Society of Victoria (Wace)
Mount Gambier: Mt Gambier Field Naturalists' Club (Dodson)
Newcastle (N.S.W.): New South Wales Geological Society, Hunter River Branch: Peter McKenzie Memorial Lecture (Thom)
New Delhi: Archaeological Survey of India (Singh)
Paris: Centre for Low Energy Radioactivity, Gif-sur-Yvette (Hope)
Pondicherry: French Institute (Walker)
Poona: Deccan College, Centre for Post-graduate archaeological Research (Singh)
Robe: Sedimentology Conference of the Geological Society of Australia (Bowler, Dodson, Thom)
Seattle: Centre for Quaternary Studies, Washington University (Hope)
Sydney: Study Group on Coastal Erosion in New South Wales (Thom)
Sydney: Institute of Engineers, Australia: Conference on Engineering Dynamics of the Coastal Zone (McLean, Thom)
Sydney: Royal Historical Society of New South Wales (Wace)
Sydney: UNESCO Conference on the Impact of Human Activities on the Coastal Zone (McLean, Thom)
Wollongong: New South Wales Geological Society, Wollongong Branch (Thom).

In addition contributions were made to advanced undergraduate courses in the following departments:

Adelaide University, Geography Department (Jennings)
Australian National University, Geography Department (Bowler, Jennings, Thom)
Melbourne University, Geology Department (Bowler)
Sydney University, Geography Department (McLean, Thom)

Several members of the Department are members of national and international committees and similar bodies appropriate to their special interests and competences.

Doctorates awarded or recommended

Coventry, R.J.	Abandoned shorelines and the late Quaternary history of Lake George, New South Wales
Hope, G.S.	The vegetation history of Mt Wilhelm, Papua New Guinea
Kershaw, A.P.	Late Quaternary vegetation of the Atherton Tableland, Northeast Queensland, Australia.
Pain, C.F.	The Late Quaternary geomorphic history of the Kaugel Valley, Papua New Guinea.

Acknowledgements

Drs Bowler and Rajaguru, in association with Professor D.J. Mulvaney (Department of Prehistory and Anthropology) have been in receipt of a substantial grant from the Australian Institute of Aboriginal Studies toward the cost of operations at Mungo, N.S.W. The same Institute has funded the whole of Dr Reeve's ethnobotanical research. Professor Walker's visits to Boulder and to India were stimulated by a considerable grant from the Smithsonian Institution of Washington. Dr Singh's field work in the Kashmir was made possible by a grant from the Physical Research Laboratory, Ahmedabad.

Dr J. Chappell (Department of Geography), Dr K.A.W. Crook (Department of Geology) and Dr N.T. Burbidge (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.

Dr D.P. Agrawal, Physical Research Laboratory, Ahmedabad
Mr J. Alcock, Greenlands, Nimmitabel, N.S.W.
Professor W.S. Benninghoff, University of Michigan, Ann Arbor
Dr F. Bradley, CSIRO, Canberra
Father H. Brady, Chevalier College, Bowral, N.S.W.
Mr J. Braybrook, Snowy Mountain Authority, Kangaroo Valley, N.S.W.
Dr R. Brewer, CSIRO, Canberra
Dr N.T. Burbidge, CSIRO, Canberra
Mr R. Callan, Geological Survey of South Australia, Adelaide
Dr S. Chanda, Bose Research Institute, Calcutta
Dr K.A.W. Crook, Geology Department, ANU
Dr Hj Eichler, CSIRO, Canberra
Mr M. Gray, CSIRO, Canberra
Mr P. Guhathakurta, Forestry Department, Darjeeling
Dr A.R. Jensen, B.M.R., Canberra
Mr K.J. Markey, Shell Carwashing Depot, Canberra
Mr C. Nankivell, Peat Mining Co., Bowral, N.S.W.
Mr R. Pullen, CSIRO, Canberra
Dr P. Roy, Geological Survey of N.S.W., Sydney
Mr J.R. Sleeman, CSIRO, Canberra
Mr C. Totterdell, CSIRO, Canberra
Mr P. Wilson, Western Australian Herbarium, Perth
Mr D. Wimbush, CSIRO, Jindabyne
Mr J.S. Womersley, Division of Botany, Department of Forests, Lae
Coastal Studies Institute, Louisiana State University, Baton Rouge
Department of the Army, Commonwealth Government (Tropical Trials Section)
Department of the Environment, Government of South Australia
The Director, French Institute, Pondicherry
New South Wales National Parks and Wildlife Service
Soil Conservation Service of New South Wales
The Herbaria of Western Australia, King's Park Perth, South Australia, Victoria, Canberra Botanic Garden, CSIRO Canberra, Florence, Geneva, Museum of National History Paris, Stockholm, Hamburg, Dublin, Royal Botanical Garden Kew and British Museum (Nat Hist) London.

Publications

Dr Thom, together with Dr J. Hope (Department of Prehistory), have initiated and edited the Australian Quaternary Newsletter, two numbers of which appeared during the year prepared and distributed by the Australian Academy of Science.

Bowler, J.M. 1973. Clay dunes: their origin, formation and environmental significance. Earth Science Reviews, 9, 322-350.

Butler, B.E.,‡ Blackburn, G.,‡ Bowler, J.M., Laurence, C.R.,‡ Newell, J.W.,‡ and Pels, S.‡ 1973. A geomorphic map of the Riverine Plain of Southeastern Australia. Australian National University Press, Canberra, 39 pp.

Costin, A.B.° 1972. Carbon-14 dates from the Snowy Mountains area, Southeastern Australia, and their interpretation. Quaternary Research, 2, 579-590.

Costin, A.B.° 1973. Characteristics and use of Australian high country. pp 1-23 in The Lake Country of Tasmania (ed M. Banks) Royal Society of Tasmania, Hobart.

Costin, A.B.° and Groves, R.H.‡ (eds) 1973. Nature Conservation in the Pacific. Australian National University Press, Canberra. 337 pp.

Costin, A.B.° Jennings, J.N., Bautovich, B.C.‡ and Wimbush, D.J.‡ 1973. Forces developed by snowpatch action, Mt Twynam, Snowy Mountains, Australia. Arctic and Alpine Research, 5, 121-126.

Costin, A.B.° and Polach, H.A.≠ 1973. Age and significance of slope deposits, Black Mountain, Canberra. Australian Journal of Soil Research. 11, 13-25.

Costin, A.B.° and Polach, H.A.≠ 1973. Slope deposits in the Snowy Mountains, southeastern Australia. Quaternary Research, 1, 228-235.

Costin, A.B.° and Wimbush, D.J.‡ 1973. Frost cracks and earth hummocks at Kosciusko, Snowy Mountains. Arctic and Alpine Research, 5, 111-120.

Dodson, J.R. 1972. Computer programs for the pollen analyst. Pollen et Spores, 14, 455-465.

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‡ Not a member of this University

o Work carried out whilst a visitor in the Department

≠ Member of the Department of Prehistory

Firman, J.B.° 1973. Regional stratigraphy of surficial deposits in the Murray Basin and Gambier Embayment. Geological Survey of South Australia Report of Investigation, No.39. 68 pp.

Frank, R.M.* 1973. Sedimentary and morphological development of the Borenore Caves, New South Wales, I. Helictite, 10, 75-91.

Galloway, R.W.‡ Hope, G.S., Löffler, E.‡ and Peterson, J.A.‡ 1973. Late Quaternary glaciation and periglacial phenomena in Australia and New Guinea. Palaeoecology of Africa and of the surrounding islands and Antarctica, 8, 125-138.

Hnatiuk, R.J.* 1972. Hymenophyllum peltatum (Poiret) Desvaux, a New Macquarie Island Record. New Zealand Journal of Botany, 10, 701-704.

Jennings, J.N. 1973. "Any millenniums today, lady?" The geomorphic bandwagon parade. Australian Geographical Studies, 11, 115-133.

Jennings, J.N. and Coventry, R.J.* 1973. Structure and texture of a gravelly barrier island in the Fitzroy estuary, Western Australia, and the role of mangroves in the shore dynamics. Marine Geology. 15, 145-167.

Noy-Meir, I.* 1973. Data transformation in ecological ordination. I. Some advantages of non-centering. Journal of Ecology, 61, 329-341.

Pain, C.F.* 1972. Characteristics and geomorphic effects of earthquake-initiated landslides on the Adelbert Range, Papua New Guinea. Engineering Geology, 6, 261-274.

Pain, C.F.* and Bowler, J.M. 1973. Denudation following the November 1970 earthquake at Madang, Papua-New Guinea. Zeitschrift für Geomorphologie Neue Folge Supplementband, 18, 92-104.

Polach, H.A.⊭ and Costin, A.B.° 1971. Validity of soil organic matter radiocarbon dating; buried soils in Snowy Mountains, south-eastern Australia as example. pp 87-96 in Palaeopedology - Origin, Nature and Dating of Palaeosols (ed. D.H. Yaalon) International Soil Science Society and Israel Universities Press.

Singh, G.,** Chopra, S.K.‡ and Singh, A.B.‡ 1973. Pollen rain from the vegetation of northwest India. New Phytologist, 72, 191-206.

Singh, G.,** Joshi, R.A.,‡ and Singh, A.B.‡ 1972. Stratigraphic and radiocarbon evidence for the age and development of three salt-lake deposits in Rajasthan, India. Quaternary Research, 2, 496-505.

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‡ Not a member of this University

° Work carried out whilst a visitor in the Department

* Former member: based on work done while working in the Department

** Based on data collected before joining the Department

⊭ Member of the Department of Prehistory

Singh, G.** and Smith, A.G.‡ 1973. Postglacial vegetational history and relative land- and sea-level changes in Lecale, Co. Down. Proceedings Royal Irish Academy, 73B, 1-51.

Thom, B.G. 1973. The dilemma of high interstadial sea levels during the last glaciation. Progress in Geography, 5, 170-246.

Thom, B.G., McLean, R.F., Langford-Smith, T.‡ and Eliot, I.ɸ 1973. Seasonal beach change, Central and South Coast, N.S.W. Institute of Engineers, Australia, National Conference Publication No.73/1, 35-42.

Wace, N.M. and Lovett, B.H.‡ 1973. Yankee maritime activities and the early history of Australia. Research School of Pacific Studies, Aids to Research Series No.A/2. Canberra. 131 + xiv pp.

Williams, M.A.J.* 1973. The efficacy of creep and slopewash in tropical and temperate Australia. Australian Geographical Studies, 11, 62-78.

Wimbush, D.J.‡ and Costin, A.B.o 1973. Vegetation mapping in relation to ecological interpretation and management in the Kosciusko alpine area. CSIRO (Aust.) Division Plant Industry Technical Paper No.32, 22 pp.

Wright, L.D.,‡ Coleman, J.M.‡ and Thom, B.G. 1973. Geomorphic coastal variability, northwestern Australia. Coastal Studies Bulletin, 7, 35-64.

Wright, L.D.,‡ Coleman, J.M.‡ and Thom, B.G. 1973. Processes of channel development in a high tide range environment: Cambridge Gulf-Ord River delta, Western Australia. Journal of Geology, 81, 15-41.

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ɸ Member of the Department of Prehistory

ɸ Member of the Department of Geography