



After the tsunami

On 26 December 2004, there was a magnitude 9.3 earthquake in the Indian Ocean off Sumatra. This resulted in a tsunami which caused the catastrophic loss of life of more than 300,000 people and major damage to infrastructure, property and the environment of many coastal and island nations of the Indian Ocean - principally Sri Lanka, Indonesia, Thailand, India, Africa and the Maldives. (A tsunami is a wave train, or series of waves, generated in a body of water by an impulsive disturbance that vertically displaces the water column.) There was minimal impact upon Australia although responses to the earthquake were registered at many tidal gauges along the various coastlines and there were a few reports of minor incidents in Western Australia caused by resultant tidal surges. The Academy has provided an update on the science of tsunamis on its educational website, *Nova: Science in the news*, at www.science.org.au/nova/045/045key.htm.

In response to this large-scale international disaster, the National Academies Forum (NAF) held a timely one-day symposium at the Shine Dome on 31 March. Entitled *After the Tsunami – Harnessing Australian Expertise for Recovery*, the symposium attracted a wide range of delegates from academia, research, government, industry and the community. The Organising Committee was chaired by NAF President Dr John Zillman, and included Academy President Dr Jim Peacock. ARC's Asia Pacific Futures Research Network and the Department of Science Education and Training (DEST) were involved in the planning of the event and DEST provided logistic support. The aim of the symposium was to provide a cross-disciplinary approach to the science, technology, social science and humanities aspects of disaster in all the phases of preparedness, recovery and rehabilitation. It is envisaged that the outcomes will provide a timely, high quality, and considered source of information for government and policy makers.

The Honourable Bruce Billson, MP, Parliamentary Secretary, Foreign Affairs and Trade, began proceedings with a measured opening address. The Honourable Tim Fischer outlined the rapid response of Australian expertise to the disaster and paid particular tribute to the federal public servants. The symposium delegates were then presented with a series of scene-setting talks which began with David Templeman, Director General of Emergency Management Australia, followed by Murray Proctor of AusAid, that is administering the Australian government's billion dollar recovery package to Indonesia. Professor Jim Fox discussed the cultural and economic aspects of disaster, and Professor Hugh Davies spoke of the lessons learned from the 1998 Papua New Guinea tsunami. Dr Phil Cummins of Geoscience Australia revealed the science and seismics of the Indian Ocean tsunami, and Dr Tony Haymet, Chief of CSIRO Marine Research, together with Dr Charlie Veron from the Australian Institute of Marine Science (AIMS), told of the progress in the Maldives with respect to assessment of coral reef and island damage. The human face of the recent disaster was boldly brought home by a joint presentation from medical

specialist Professor Beverley Raphael and forensics expert Dr Jim Robertson, both of whom spent time with victims of the tsunami.

The delegates then formed into eight focus breakout groups to undertake the interactive brain-storming component of the day. The topics covered:

- warning and preparedness;
- sustainable reconstruction;
- health systems;
- continuity of knowledge;
- governance and policy;
- longer-term issues: economic, social, cultural, environmental;
- technology and ICT for rehabilitation;
- understanding and harnessing community response.

Rapporteurs from each group reported outcomes and a general discussion ensued. A summary of the day was provided by Professor Kurt Lambeck, followed by Dr John Zillman's closing remarks. Rapporteurs worked with Academy staff to develop a final report. This report, together with the symposium proceedings will soon be available on the NAF website at www.naf.org.au.



From left: Professor Kurt Lambeck, Australian Academy of Science; the Honourable Bruce Billson, MP; the Honourable Tim Fischer; and Dr John Zillman, President, National Academies Forum.

New Fellows elected (see page 2)

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Fax: (02) 6257 4620

Email: aas@science.org.au

Honorary editor:

Professor Neville Fletcher FAA

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New Fellows

The Academy congratulates the following scientists who were elected to the Fellowship on 24 March. More information on our new Fellows will appear in the next *Newsletter*.

Professor Samuel Berkovic, FRACP

Professor, Epilepsy Research Centre, Austin Health, University of Melbourne

Professor Michael Eastwood

Professor, Department of Mathematics, University of Adelaide

Dr Jeffrey Ellis

Research Scientist and Program Leader, Genetic Engineering for Plant Improvement, CSIRO Plant Industry, Canberra

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Professor Stephen Hyde

Federation Fellow and Professor of Physics, Department of Applied Mathematics, Research School of Physical Sciences and Engineering, Australian National University

Professor Chennupati Jagadish

Federation Fellow and Professor, Department of Electronic Materials Engineering, Research School of Physical Sciences and Engineering, Australian National University

Professor Trevor Lamb, FRS

Federation Fellow, Division of Neuroscience, John Curtin School of Medical Research, Australian National University

Professor Geoffrey McFadden

Professor, School of Botany, University of Melbourne

Professor Amnon Neeman

Professor, Centre for Mathematics and its Applications, Australian National University

Professor Hugh Possingham

Professor and Director, The Ecology Centre, University of Queensland

Professor John Ralston

Professor and Director of Physical Chemistry and Minerals Processing, Ian Wark Research Institute, University of South Australia

Forthcoming events

- Science at the Shine Dome and AGM, 4-6 May 2005.
See www.science.org.au/sats2005.

International exchanges

- The Academy is currently inviting applications for its next round of Scientific Visits to Europe, North America and Asia. The deadline for these applications is 24 June 2005. See www.science.org.au/internat for application forms and selection criteria.

New topics on Nova

- Population and the environment — what's the connection?

www.science.org.au/nova

Haddon King Dinner

Professor Ross Large, Professor of Geology and Director of the ARC Centre for Ore Deposit Research, University of Tasmania, will be presented with the Haddon King Medal for 2005 at a dinner on 22 July, at the Woodward Centre, University of Melbourne. Please contact Faye Nicholas (email ac@science.org.au or phone (02) 6247 5777) if you would like to attend.

Gifts to the Academy

If you would like to make a gift or a bequest to the Academy please contact the Executive Secretary, Professor Sue Serjeantson, on (02) 6247 5777 or es@science.org.au.

Modern humans shown to be 195,000 years old

by Professor Ian McDougall, FAA
Emeritus Professor
Research School of Earth Sciences
Australian National University

Recently published results show that modern humans (*Homo sapiens*) were living in east Africa in southern Ethiopia some 195,000 years ago.* This extends the presently known history of our own species back a further 40,000 years than previously thought.

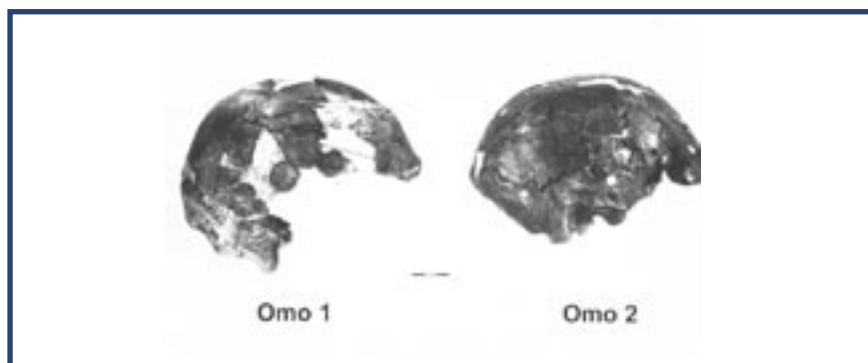
In 1967 an expedition led by a youthful Richard Leakey of the National Museums of Kenya, as part of the Omo International Expedition in southern Ethiopia, found hominid cranial remains in flat-lying sediments of the Kibish Formation, adjacent to the Omo River, which drains into Lake Turkana further south. The skull fragments were reassembled and described by Michael Day (then with the Middlesex Hospital Medical School, London), who assigned them to *Homo sapiens*, similar to modern humans, although he thought the cranium known as Omo II was somewhat more primitive than Omo I. At the time the sediments containing the fossils were dated as about 130,000 years old, although the researchers questioned the validity of the date. Indeed, the idea that modern humans were over 100,000 years old seemed very unlikely.

During the past few decades these fossils, and especially Omo I, have become very important evidence for the 'Out of Africa' hypothesis that modern humans (*Homo sapiens*) first evolved in Africa and subsequently migrated to other parts of the world. However, many people have questioned the evidence from Kibish because of the differences between the two skulls and because of doubts about the dating techniques used in 1967. Were Omo I and Omo II really from essentially the same stratigraphic level? Were they really that old?

Beginning in 1999, an international group of researchers returned to Kibish to collect more information in an attempt to resolve these questions. I was part of this team, led by Dr John Fleagle (Stony Brook University, New York) and Dr Zelalem Assefa from Ethiopia, together with Dr Frank Brown (University of Utah) and a number of other researchers. During successive expeditions many more fossils were recovered, and further

detailed studies of the geology of the region were undertaken. This work showed that the hominid fossils are from essentially the same stratigraphic level. Importantly, we have been able to measure precise isotopic ages by the $^{40}\text{Ar}/^{39}\text{Ar}$ dating technique in the excellent facilities at ANU on feldspar crystals from small pumice clasts within tuff layers deposited following contemporary explosive volcanic eruptions. The new ages show that Member I of the Kibish Formation, where the hominid fossils were found, is about 196,000 ($\pm 2,000$) years old.

Sea. Sapropels are deposited under low oxygen conditions, in many cases thought to have been caused by major influxes of fresh water to the Mediterranean from the Nile River system during intervals of extremely high monsoonal rainfall in the Ethiopian highlands. The Omo and Nile river systems share drainage divides; thus, the high rainfall is reflected also in high levels of Lake Turkana, and in the location of the deposition of the individual members of the Kibish Formation. The ages determined at Kibish closely match



Higher up the sequence, in Member III, a tuff was dated at 104,000 years old, and from previous work Member IV is known to have been deposited between about 10,000 and 3,000 years ago.

Geological studies show that each member of the Kibish Formation was laid down quickly in a deltaic environment associated with the Omo River where it entered Lake Turkana. This is about 100 kilometres north of where the Omo River currently reaches Lake Turkana, so that at the time of deposition of the Kibish Formation, Lake Turkana was at considerably higher levels than at present, by from about 35 to 85 metres. These high lake levels indicate much greater precipitation and runoff from the highlands of Ethiopia, the source of the waters in the Omo River.

We have also shown that the members of the Kibish Formation were deposited essentially contemporaneously with unusual and distinctive sediments (known as sapropels) in the Mediterranean

those of three of the sapropels in the Mediterranean which have been dated by other means, effectively linking the systems.

On the basis of the measured ages, the evidence for rapid deposition of the members of the Kibish Formation, and the correlations with the sapropels, the fossil hominids are about 195,000 years old. These are the oldest well-dated fossils of modern humans currently known from anywhere in the world. They are about 40,000 years older than the hominid fossils from Herto in the middle Awash region, Ethiopia.

The age of 195,000 years for modern humans is very close to that estimated from genetic studies related to the origin of *Homo sapiens*. The Kibish fossils also indicate that already at this time there was considerable diversity among the hominids living in Ethiopia.

* I. McDougall, F.H. Brown and J.G. Fleagle (2005) Stratigraphic placement and age of modern humans from Kibish, Ethiopia. *Nature* 433, 733-736.

International news

Brazil

Professor Cylon Gonçalves da Silva, National Secretary for Policy and Programs of Research and Development at Brazil's Ministry of Science and Technology, visited the Academy on 1 March. He was accompanied by His Excellency, Mr Frederico Cezar de Araujo, Ambassador of Brazil to Australia, and Mr Aurélio Garcia-Avelino, First Secretary at the Embassy.

Professor Gonçalves da Silva was in Australia to follow up on discussions held during the Sixth Senior Official Talks between Australia and Brazil held in Canberra on 10 February. At the meeting on 1 March, the Academy's Executive Secretary, Professor Sue Serjeantson, gave the Brazilian group an overview of the Academy's activities. David Smith, Director, International Science and Technology Relations Section of the Department of Education, Science and Training (DEST), also attended the meeting and spoke about the Forum on European-Australian Science and Technology (FEAST), a topic of specific interest to Professor Gonçalves da Silva. FEAST is supported by the European Commission as well as DEST.

Indonesia

The Academy was invited to attend a bilateral science and technology meeting at the Department of Education, Science and Training with representatives of the Indonesian Ministry of Research and Technology, on 16 March. Dr Roosmalawati Roosman, Assistant Deputy Minister for Social Science and Humanities, and Mrs Nada Marsudi, Head of the Division for the Assessment of International Science and Technology Policy, were in Australia to take part in the Australia-Indonesia Ministerial Forum.

Representatives from ACIAR, CSIRO, DSTO and NHMRC attended the meeting and gave presentations on their current activities with Indonesia. The Academy and the Australian Academy of Technological Sciences and Engineering have a Memorandum of Understanding with the Commission for Engineering Sciences and the Commission for Basic Sciences of the Indonesian Academy of Sciences.

An agreement of cooperation in scientific research and technological development between Australia and Indonesia will be signed shortly.



From left: David Smith, Professor Cylon Gonçalves da Silva, Professor Sue Serjeantson, Frederico Cezar de Araujo and Aurélio Garcia-Avelino.

Support for International Collaborative Research

The Academy is inviting applications from research scientists to visit Europe, North America (USA, Canada and Mexico), and North East Asia (China, Japan, Korea and Taiwan), between 1 July 2006 and 30 June 2007, to collaborate with researchers in those countries. These programs are administered by the Academy and funded by the Department of

Education, Science and Training's International Science Linkages Programme, an initiative of the Government's Innovation Statement, *Backing Australia's Ability - Building Our Future through Science and Innovation*.

Information, deadlines and application forms are available at www.science.org.au/internat/index.htm.

Research quality assessment

The Minister for Education, Science and Training, Dr Brendan Nelson, has announced the formation of a 13-member Expert Advisory Group which will develop a Research Quality Framework for publicly funded research. The framework will be designed to measure the quality of research conducted in Australia's universities and publicly funded research agencies and its benefits to the wider community.

The Expert Advisory Group will be chaired by Professor Sir Gareth Roberts, President of Wolfson College in Oxford, and will undertake a broad

consultative process before reporting to the government by the end of this year. In the lead up to the review, a series of consultative workshops were held by the Department of Education, Science and Training with each of the four learned academies and finally with the National Academies Forum. The workshops considered issues of quality assessment in both disciplinary and interdisciplinary research contexts and were facilitated by representatives of Allen Consulting.

More information is available at www.dest.gov.au/resqual.

Tsunami warnings in a global context?

by Professor Brian Kennett, FAA

Professor of Seismology
Research School of Earth Sciences
Australian National University

Following the great Sumatran Earthquake on 26 December 2004 with its attendant tsunami there have been strident calls for a tsunami warning system for the Indian Ocean to match that which has been in place for the Pacific since the mid-1960s.

In the Pacific Ocean the impact of tsunamis comes not just from local earthquakes, but from major earthquakes elsewhere around the basin. A formal warning system was established in Hawaii after devastation from a 1946 earthquake in the Aleutian chain, and this was extended to the whole Pacific following the impact of tsunamis from the 1960 event off the coast of Chile. The system works because the seismic waves produced by earthquakes travel through the Earth with high velocity and reach to even 12,000 kilometres away from the source in less than 15 minutes, whereas the tsunami waves travel at speeds comparable to jet aircraft and take hours to cross a major ocean basin. The Pacific centre monitors the signals from seismic stations across the globe and can issue a tsunami watch notice within 30-40 minutes of an earthquake that might be capable of generating a tsunami. When tide stations near the earthquake confirm the generation of a tsunami, the watch notice becomes a warning accompanied by predicted arrival times at different locations. The cooperating countries are then responsible for acting on this warning for the benefit of their populations.

Most tsunamis are produced by earthquake activity beneath the sea, either by direct deformation of the seabed or by submarine slumping of the seafloor induced by an earthquake. Other circumstances come from explosive volcanism at sea as in the destruction of the island of Krakatoa in Indonesia in 1883, or, potentially, from the impact of a large meteorite on the ocean.

There is unfortunately little that can be done to provide warnings in the immediate neighbourhood of a tsunami-generating earthquake, since the interval between the ground shaking and the arrival of the ocean

waves is so short. Such was the effect on the north coast of Papua New Guinea in 2001 and on the Aceh coast in this recent great earthquake.

To understand what we can hope to achieve with a warning system we need to understand the nature of the class of earthquakes that are likely to produce damaging tsunami effects. The earthquake needs to be big and occur in the marine environment. The source process has to produce vertical deformation of the sea-floor so that large volumes of water are displaced to set in motion the waves that cross the oceans. These circumstances are met for shallow events 'megathrusts' on the subduction zones where oceanic material is descending into the interior of the Earth. The recent event off Aceh is of this nature, with a combination of both horizontal and vertical motion. Detailed studies by different groups around the world indicate that there was a strong initial disturbance followed about a minute later by much larger fault displacement starting about 200 kilometres further north extending for a further 300-400 kilometres along the plate boundary. Weaker slow faulting completed the process for a total fault length exceeding 1000 kilometres, running from northern Sumatra past the Nicobar Islands to the Andaman Islands.

The initial faulting created the tsunamis that hit the Aceh coast. The strong waves radiated toward Thailand that have cost the lives of so many visitors were induced by the second phase of the earthquake. An event further south along the Sumatran coast would have produced a much smaller effect on the Thai coast. The dominant orientation of the thrust fault is slightly east of north and this lead to strong radiation of tsunami energy to the east to reach the coasts of the Maldives, Sri Lanka and India. The weaker faulting in the north meant that little tsunami energy was transmitted towards Bangladesh and Burma, where casualties have been low.

There have been strong tsunamis in the northern Sumatran region before, notably in 1861 and 1833, at locations slightly further south than 2004. Stress has to build up over a long period before it is released in a great earthquake and so such events do not

occur frequently. Seismological studies can indicate the potential for large earthquakes, but even in those regions such as Japan and California with the most comprehensive instrumentation the goal of earthquake forecasting remains elusive.

Outside the Pacific Rim that has many different subduction zones, the frequency of potential tsunamis is quite low. This is why warning systems for the Indian Ocean, for example, have in the past been a low priority. The long time span between events also imposes a difficult burden if a warning system is established: constant vigilance but highly infrequent activity.

The international community has made an extraordinary investment in global monitoring capability, particularly in seismology, through the 1996 Comprehensive Nuclear-Test-Ban Treaty with the object of detecting any clandestine testing of nuclear devices. Data is transmitted by satellite to an International Data Centre in Vienna where automated estimates of event location are made, to be later refined by careful analysis. The system is not yet fully operational because the treaty has yet to enter into force. Yet we have here the capability for a global system for tsunami warnings to relevant governments particularly with additional technical investment in ocean tide gauges. Australia played a major role in securing the signing of the 1996 treaty, let us continue the process of 'beating swords into ploughshares' by turning the already existing investment to greater humanitarian benefit.

This article was first published in *The Canberra Times*, 11 January 2005.

See the Academy's *Nova: Science in the news* topic 'Calculating the threat of tsunami' at www.science.org.au/nova/045/045key.htm.

Newsletter online

To receive email notification when new issues of the *Newsletter* become available online, register at www.science.org.au/infolist.htm.

Adam J Berry Memorial Fund

Cathryn Hogarth, a PhD student at the Australian Research Council Centre of Excellence in Biotechnology and Development, Monash Institute of Medical Research, is the winner of the 2005 Adam J Berry Memorial Fund award. The award was established in memory of a young Australian scientist and assists an Australian researcher to travel or work in the USA at one of the institutes of the National Institutes of Health (NIH) each year. The fund is co-managed by the Academy and the Foundation for the US National

Institutes of Health.

This year's award will assist Cathryn to travel to the National Institute of Environmental Health Sciences in North Carolina. She will stay there for two months conducting research relating to her PhD thesis on nuclear transport and cellular differentiation in the fetal mouse gonad.

Information about the Adam J Berry Memorial Fund can be obtained by contacting Nancy Pritchard (nancy.pritchard@science.org.au).



Cathryn Hogarth

The changing atmosphere

More than 200 people gathered at the Shine Dome in Canberra on 21 February to hear US Nobel Laureate Professor F Sherwood Rowland's public lecture, 'The changing atmosphere in 2005'.

Professor Rowland, who shared the 1995 Nobel Prize in Chemistry with Paul J Crutzen and Mario J Molina, is the Donald Bren Research Professor of Chemistry and Earth System Science at the University of California, Irvine. He gave an enlightening talk on the chemical changes that are happening in the Earth's atmosphere. He discussed the effect of chlorofluorocarbons (CFCs) on the ozone layer and the increasing levels of carbon dioxide in the atmosphere. But it wasn't all doom

and gloom. Professor Rowland spoke of the Montreal Protocol of 1987 which led to a ban on CFC production. The result is that levels of some CFCs in the atmosphere are stabilising and others are decreasing. 'It means the Montreal Protocol is working extremely well,' he said and that 'there are a whole lot of things that can be done, once you decide that you are going to do it.'

Professor Rowland's visit to Australia was sponsored by the Trustees of the Kenneth Myer Bequest to the Howard Florey Institute. The transcript of the lecture and accompanying presentation slides are available at www.science.org.au/events/rowland.

Sustainability options online conference

The Joint Academies Committee on Sustainability is hosting an online conference on the topic of *Integrated Sustainability Assessment*. In the lead up to this conference, the National Academies Forum conducted an ARC-funded research project – *Sustainability Options in Australia* – from March to December 2004, to identify best-practice in sustainability research that is successfully integrated.

In order to initiate the online discussion, papers on five core topics – energy, institutions, social process, urban systems and water – have been prepared by eminent Australian researchers such as Professor Ian Lowe, Professor Nancy Millis and Professor Peter Newman. The papers have already attracted responses from other eminent professionals including Dr Barney Foran and Dr John Williams.

The conference is now open for general discussion at www.naf-forum.org.au and will run from March to June 2005. Comments are invited on the contributed papers or on any other issues related to integrated sustainability assessment. The project's Study Director, Dr Thomas Brinsmead, has prepared a report on methodological options which is available at the website.

For further information email thomas.brinsmead@newcastle.edu.au.



Professor F Sherwood Rowland (right) with Dr Jim Peacock (left) and Dr Derek Denton.

2004 J G RUSSELL AWARD

Age of a new hominin in Flores

by Dr Chris Turney

QEII Fellow

GeoQUEST Research Group
School of Earth and Environmental
Sciences
University of Wollongong

In collaboration with Indonesian scientists (and under the project guidance of Professor Michael Morwood, University of New England) we have been working on a number of sites across Wallace's Line that contained evidence for human arrival in Southeast Asia. Wallace's Line is the most significant biogeographical boundary in Southeast Asia. Throughout the last 2 million years, at times of low sea level, islands to the west of the 'line' (eg, Java) were joined to the Asian mainland and as a result had very similar wildlife. In contrast, islands to the east (eg, Flores) continued to be separated by sea barriers and contained a distinctly different wildlife, more closely associated with Australia. The presence of humans in islands to the east therefore indicated an ability to build boats. It was across Wallace's Line that the first humans must have migrated to reach Australia (sometime before 47,000 years ago). The most likely route for human migration into Australia was down through the Indonesian Archipelago. By examining early sites in Indonesia we hope to get a potential minimum age for the first modern humans in this part of the world and the earliest date for their migration to Australia.

Working in a large cave called Liang Bua (on the island of Flores) and against all expectations, we have identified the remains of a new human species that was pygmy-sized, with a small brain capacity (380 cc) and apparently preserving many ancient features, including distinctive teeth, a sloping forehead and relatively long arms. The species has been named as *Homo floresiensis*, but more affectionately known as 'the Hobbit'. To put the brain size in perspective, modern humans have a brain capacity of around 1400 cc. 'The Hobbit' was more comparable to a chimpanzee in brain size yet apparently capable of making stone artifacts. It was later discovered that bones from at least a further six individuals were in the

sequence up to a prominent volcanic ash horizon. Using the latest methods in radiocarbon sampling, pretreatment and measurement I have analysed several charcoal samples associated with the skeletal remains. The ages indicate that the principal skeleton lived around 18,000 calendar years ago, while the most recent bones immediately below the ash were dated to just over 13,000 calendar years ago, immediately below a significant volcanic ash horizon, suggesting that the latter may have led to their extinction. I have now completed geochemical analyses of the glass shards within the ash horizon.



Liang Bua Cave. (Photo: Chris Turney, University of Wollongong). More images are available at www.uow.edu.au/science/eesc/staff/cturney/ct.html.

The work has important implications for our understanding of human evolution and migration. Traditionally it was considered that one early migration of 'ancient' early humans (*Homo erectus*) took place 'out of Africa' 2 to 1 million years ago and colonised large parts of Asia and Europe. For modern human origins, there are two major hypotheses: 'out of Africa' where the *H. erectus* that had remained in Africa evolved into *H. sapiens* and colonised the world 100,000 to 50,000 years ago, displacing any ancient populations; and 'multi-regional' where ancient populations in different parts of the world independently evolved into *H. sapiens*.

We now know an early population of *H. erectus* migrated out of Africa sometime around 1.8 million years ago.

Stone tools found at other sites in Flores indicate one species of hominin had arrived in Flores by 880,000 years ago. If this is the case, the species was capable of building a boat to cross Wallace's Line from a considerably early period of human evolution. Furthermore, the ancient features clearly indicated that 'the Hobbit' and its kind had not evolved into our species, strongly arguing against the multi-regional hypothesis for modern human evolution.

The J G Russell Award I received on taking up my QEII Fellowship was extremely useful for my research. The money directly paid for my flight and fieldwork costs during a two-week fieldtrip in Flores, including sampling at Liang Bua. The Award was acknowledged in the publication in *Nature* (Morwood *et al.*, 2004) reporting this work.

M J Morwood, R P Soejono, R G Roberts, T Sufikna, C S M Turney, K E Westaway, W J Rink, J-X Zhao, G D van den Bergh, R A Due, D R Hobbs, M W Moore, M I Bird and L K Fifield (2004) Archaeology and age of *Homo floresiensis*, a new hominin from Flores in eastern Indonesia. *Nature*, 431, 1087-1091.

Archives of AJSR online

In November 2004, CSIRO Publishing launched the online archive of *Australian Journal of Agricultural Research (AJAR)* comprising all papers published between 1950 and 1996. This research had been previously available only in print format.

Prior to releasing the archive there was speculation that the effort of digitising the 49,829 pages of research might be wasted. What if no one was interested in the archival material?

The response from readers has been phenomenal, however, and any concerns about researchers' interest in archival content have been completely dispelled. In the four months since the November release, 20,962 *AJAR* papers were downloaded with over 53 per cent of papers from the material previously locked in print archives.

CSIRO Publishing has subsequently released online archives of four more journals and plans to publish the back issues of all eleven of the Australian Journals of Scientific Research (AJSR) during 2005.

The Australian Journals of Scientific Research are published by CSIRO Publishing under an agreement between the Australian Academy of Science and CSIRO. The print archives of the AJSR date from 1948 and include thousands of articles. Over the last two years, CSIRO Publishing has worked out the data structures needed to deliver a reasonable product to users

and the various technologies and options for doing the actual work.

Collaboration between CSIRO Publishing, CSIRO Livestock Industries and the Sheep and Cattle CRCs provided the technology to commence work. The project is being funded by CSIRO Publishing and the Sheep and Cattle CRCs in Armidale provided support for the agricultural journals.

In February online archives of *Australian Journal of Experimental Agriculture*, *Australian Journal of Soil Research*, *Australian Systematic Botany* and *Invertebrate Taxonomy* (as the predecessor of *Invertebrate Systematics*) were released.

Reproduction, Fertility and Development, *Wildlife Research* and *Australian Journal of Botany* will be released in the next few months. *Australian Journal of Marine and Freshwater Research* (the predecessor of Marine and Freshwater Research), *Australian Journal of Plant Physiology* (the predecessor of *Functional Plant Biology*), *Australian Journal of Chemistry* are scheduled for the second half of 2005. *Australian Journal of Zoology* will be published together with *Zoological Supplements*, which comprise 127 taxonomic papers.

Work on the digital archive is expected to be completed by the end of 2005. Subscribers can view the archive at www.publish.csiro.au/journals.

Biodiversity conference

The international conference on *Biodiversity: Science and governance* was held at the Paris headquarters of UNESCO from 24-28 January, and was organised by a number of the international Scientific Unions to which the Academy adheres. Corresponding Member Dr Peter Raven (pictured below), Director of the Missouri Botanical Garden, chaired the first plenary session which addressed challenges faced by science and governance with regard to biodiversity. Dr Raven noted that more is known about the moon than about the Earth's rainforests and called for more research and decisive actions and strategies to conserve biodiversity. UNESCO's Mr Natarajan Ishwaran said that the decision by the Australian government to increase non-catch zones in the Great Barrier Reef exemplifies a clear interaction between science, governance and policy makers.



National Research Priorities Standing Committee

The Minister for Education, Science and Training, Dr Brendan Nelson, has appointed a National Research Priority Standing Committee to oversee the implementation of the National Research Priorities (NRP) and develop medium and longer-term strategies for the initiative. The Committee is chaired by the Chief Scientist, Dr Robin Batterham.

The inaugural meeting of the new Standing Committee was held at the end of March. The Committee will provide feedback to the 22 NRP-reporting agencies about their revised NRP implementation plans, and NRP-Implementation Progress Reports for 2004. It will also decide on a future reporting arrangement.

Membership of the new Standing Committee includes:

- Dr Jim Peacock, Fellow, CSIRO Plant Industry and President of the Australian Academy of Science.
- Professor Henrique d'Assumpcao, Emeritus Professor at the University of South Australia.
- Hugh Morgan, Principal of First Charnock, a Director of the Board of the Reserve Bank of Australia and President of the Business Council of Australia.
- Professor Sue Rowley, Pro Vice-Chancellor (Research) at Sydney's University of Technology.
- Terry Enright, Chair-of-Chairs of the rural Research and Development

Corporations and Chair of the Grains Research and Development Corporation.

- Associate Professor Bob Beeton, University of Queensland.
- Professor Suzanne Cory, Director of the Walter and Eliza Hall Institute of Medical Research and Professor of Medical Biology at the University of Melbourne.
- Professor Brian Anderson, Chief Scientist of National ICT Australia and Distinguished Professor in the Research School of Information Sciences and Engineering, Australian National University.

More information about the National Research Priorities is at www.dest.gov.au/priorities.

Interviews with scientists

The Academy's *Interviews with Australian Scientists* project continues to grow, with 92 interviews now completed. The edited transcripts of interviews with Academy Fellows Professor Athel Beckwith, Professor Stephen Boyden and Professor Stewart Turner have recently been added to the project's website at www.science.org.au/scientists.

Professor Athel Beckwith is an organic chemist whose work has covered a number of areas ranging from theoretical calculations to the synthesis of complex molecules. In his interview with Professor Bob Crompton, he discusses his research into the structure and behaviour of organic free radicals. He describes growing up in Perth, his battle with osteomyelitis and his first forays into science, 'I started doing my own science at home, because having a father who was a pharmacist gave me ready access to all the things one needs for the sorts of experiments that young chaps like doing – thermite mixture and explosions, smells, and bangs.' He is a Fellow of the Royal Society, a Fellow and Past President of the Royal Australian Chemical Institute and is currently an Emeritus Professor at the Australian National University.

Professor Stephen Boyden has had a wide and varied career. He originally trained as a veterinarian, before moving into research in bacteriology and immunology. However, he is perhaps best known for his work in the field of human ecology and human

biohistory. He was the Director of the ANU's Hong Kong Human Ecology Program, a consultant to UNESCO's Man in the Biosphere Program and recently published the book *Biology of Civilisation*. In his interview with Professor Frank Fenner, Stephen reveals that his interest in the life sciences began as a child in London, 'I still remember giving lectures to the other boys on tadpoles and things of that sort and I was curator of the school's museum.' He is a Visiting Fellow at the Australian National University's Centre for Resource and Environmental Studies and is deeply involved in the activities of the Nature and Society Forum.

Professor Stewart Turner, a geophysicist with a distinguished career spanning three continents, was interviewed by Dr Trevor McDougall in September 2004. Professor Turner began his research in theoretical nuclear physics before changing to cloud physics. He established the connection between the physical processes in the ocean and liquid rocks (lava and magma), and wrote the influential book, *Buoyancy Effects in Fluids*. 'What I have enjoyed most is identifying and understanding various novel physical processes. The hands-on experience of making an experiment work in the laboratory, once I have devised it, is great fun.' He has received numerous awards and continues to be active in research as Emeritus Professor and Visiting Fellow at the Australian National University.



Dr Trevor McDougall (left) with Professor Stewart Turner.

NOVA: SCIENCE IN THE NEWS

Population and the environment

'Population and the environment - what's the connection?' is the latest topic on the Academy's educational website, *Nova: Science in the news*.

The world's population is growing, and many scientists and conservationists say that the environment is deteriorating as a result.

Although some aspects of the Australian environment are in relatively good condition, Australia has many environmental problems: land degradation, endangered species, an increasing incidence of toxic algal blooms in our rivers, declining fish stocks, land clearing, air pollution, vulnerable water supplies.

Some of Australia's environmental problems can be attributed to poor management techniques, policy failure or even feral animals. Such factors are largely independent of population. But the sheer number of people can also contribute to the problems.

As monetary wealth has increased in Australia, so has consumption. High levels of consumption help to deplete our store of resources, generate waste and increase the stress on the natural and agricultural environments.

When Australian consumption is viewed in a global perspective, we leave a large 'ecological footprint'. In 2004 Australia's ecological footprint was calculated at 7.7 hectares per person compared to the average global footprint of 2.2 hectares. Clearly the consumption of resources at current levels is not sustainable.

To come up with the best solution, insights and ideas need to be drawn from many disciplines. These include, but are not limited to, environmental science, geology, economics, demography, human biology and health, geography and political science.

This topic, available at www.science.org.au/nova, was developed with support from the Academy's Population and Environment Fund. The principal sponsor of Nova is the Commonwealth Bank Foundation.

Scientific linkages

The Academy was funded under the ARC's Learned Academies Special Projects Scheme to undertake a study in 2004-2005 entitled *Maximising the Benefits from Australia's Formal Linkages to Global Scientific Activities*. The project was guided by a steering group chaired by Professor Kurt Lambeck.

The outcomes of the project were as follows:

- An inventory was assembled of significant global scientific organisations and collaborative opportunities in which Australian scientists might reasonably be expected to be involved.
- Descriptions of the aims and objectives of those research programs, including the sponsoring bodies, involved governments and countries, and the progress and outputs to date.
- An analysis of the extent to which Australia is currently engaged in these programs.
- An analysis of the benefits that flow from Australia's engagement in global scientific research programs.
- An assessment of the nature and extent of the gaps between current participation in global scientific programs and potential opportunities, with a particular emphasis on the National Research Priorities.
- An evaluation of mechanisms to enhance Australian scientific involvement in global scientific programs, including the mechanism of subscriptions to international scientific organisations.

The study found that Australia has extensive formal links with global scientific activities and positive benefits are flowing to the Australian scientific community as a result of this engagement. There are also some new international science activities that are arising in worthwhile emerging areas and, if appropriate, Australia should seek to extend its membership to participate in these global scientific programs.

The project report will be available on the Academy's website soon. Email Chris Warris (chris.warris@science.org.au) for more information.

Primary Connections on trial

Academy President, Dr Jim Peacock, and Yvonne King, from the ACT Department of Education and Training, visited Narrabundah Primary School in Canberra on 8 March to watch lessons from *Primary Connections* being trialled in the classroom.

Primary Connections is a new initiative linking the teaching of science with the teaching of literacy in Australian primary schools. It is a partnership between the Academy and the Department of Education, Science and Training.

More than 100 primary school teachers from 56 schools across Australia attended a week-long professional learning workshop in Canberra in January and are now trialling units of work from *Primary Connections*.

The feedback from these teachers will be vital for fine tuning the program ahead of assessment of its suitability for full implementation in schools in 2006.

More information is available at www.science.org.au/primaryconnections.



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Erin Woodruff and Dean Saddler from Narrabundah Primary School, one of the *Primary Connections* trialling schools.

Research infrastructure submission

The Academy recently answered a call for submissions in response to a discussion paper prepared by the National Collaborative Research Infrastructure Strategy (NCRIS) Advisory Committee. The submission was largely assisted by reports from many of the National Committees who provided detailed information on various infrastructure and skills aspects of their disciplines.

The Academy has long argued that the *ad hoc* nature of earlier competitive rounds for Major National Research Facilities (MNRFs) did not serve the nation well as it lacked a strategic component and mitigated against long-term strategic planning and against the building up of long-term collaborative partnerships. As the Academy pointed out in 2003 in its submission to the National Research Infrastructure Taskforce (NRIT), the states and territories, together with overseas agencies and international organisations, are in a position to make substantial contributions to

MNRF and larger-scale research facility funding. It is therefore in the national interest that there be no administrative impediments to this potentially important avenue for leveraging federal funding. The federal government, in its commitment to NCRIS, has provided the opportunity for states and territories to improve their capacity and scope for leverage on this resource. States and territories that have yet to do so can help to improve the scope for leverage by creating programs designed to fund research infrastructure, and in so doing significantly improve the capabilities in the Australian science and innovation system.

The NCRIS consultation paper sought comments on a number of implementation issues. The Academy provided comment on three of these issues in addition to the extensive information from the National Committees. The submission is available at www.science.org.au/reports.

John Carver



John Henry Carver was born in Sydney on 5 September 1926 and died in Canberra on 25 December 2004. He was educated at the University of Sydney (BSc 1947, MSc 1948) and the University of Cambridge (PhD 1953, ScD 1975).

He began his career in the Department of Nuclear Physics at the Australian National University, where he worked as a Research Fellow, Fellow and Senior Fellow. In 1961 he moved to the University of Adelaide as Elder Professor of Physics, returning to the Australian National University in 1978 as Director of the Research School of Physical Sciences. There he introduced two new departments with links to technology and engineering, thereby demonstrating the relevance

of physics to the real world. During his directorship the school was renamed the Research School of Physical Sciences and Engineering. While at the ANU he also played a leading role in founding the University's commercial arm, ANUTech, in 1986; he later became a director of this enterprise.

Carver's early research career was in the area of experimental nuclear physics, particularly nuclear photodisintegration (the subject of his PhD thesis), the inverse problem of radiative capture and related topics in nuclear spectroscopy. However, on his move to Adelaide he took advantage of being close to the Weapons Research Establishment and shifted his interest to atmospheric physics. His rocket experiments to measure the absorption of solar ultraviolet radiation in the upper atmosphere provided the first direct measurements of mesospheric molecular oxygen densities in the southern hemisphere. The Australian satellite Wresat was launched from Woomera on 29 November 1967 with a payload consisting of UV experiments designed and built by Carver's group; Carver himself led the scientific program and was heavily involved in all phases of it. Later he became

interested in the theoretical modelling of planetary atmospheres and the study of the evolution of the Earth's atmosphere, the latter providing interesting insights into the causes of glaciation.

Carver joined the Radio Research Board in 1964 and was Chair from 1977 to 1982. His service to science also included positions as Chair of the Anglo-Australian Telescope Board and Deputy Chair of the Australian Science and Technology Council (ASTEC). In the international sphere he was Chair of the United Nations Scientific and Technical Sub-Committee on the Peaceful Uses of Outer Space for 26 years, receiving the UN's COSPAR Medal in 2000 in recognition of his contribution.

In 1986 Carver was elected to the Academy and appointed a Member of the Order of Australia. The ANU honoured him in 1994 with the opening of the John Carver Building at the Research School of Physical Sciences and Engineering.

He is survived by his wife Mary, sons John and Robert, daughters Jane and Mary Ann, and sixteen grandchildren.

Honours to Fellows

Professor Allan Canty, University of Tasmania, has been awarded the Royal Society of Chemistry Australasian Lectureship for 2005.

Professor Ian Frazer, University of Queensland, has been awarded the Australian National University's Curtin Medal for outstanding contributions to medical science.

Professor Brian Kennett, Australian National University, has been awarded a Humboldt Research Award for study in Germany at the University of Munich.

Professor Ross Taylor, Australian National University, has been awarded a Heritage Fellowship by the Lunar and Planetary Institute, Houston, Texas.

Australia Day honours

Professor Derek Denton, University of Melbourne, was awarded the Companion of the Order of Australia (AC) in the Australia Day honours list.

The award was for service to science through leadership in medical research in the field of physiology relating to sodium homeostasis and the body's regulation of fluid and electrolyte balances and to the arts.

Professor Nicos Nicola, Walter and Eliza Hall Institute of Medical Research, was appointed an Officer of the Order of Australia (AO) in the Australia Day honours list. The award was for service to scientific research and to policy development within the field of cellular and molecular biochemistry and to the development of medical biotechnology in Australia.

Biographers

Memoirs of deceased Fellows are published in *Historical Records of Australian Science* and are also available on the Academy's website at www.science.org.au/academy/memoirs.

The biographers for **Dr Brian Robinson** are Dr John Whiteoak and Ms Helen Sim.

June launch for *Cosmos*

Academy Fellows Professor Mike Archer and Professor Robyn Williams (Chairman) have been appointed to the Editorial Advisory Board of Australia's newest popular science magazine, *Cosmos*. Other members include Professor Judith Whitworth, Director of the John Curtin School of Medical Research, and Dr Bryan Gaensler, Assistant Professor in Astronomy at Harvard University.

There will be eleven issues of *Cosmos* a year, with the first issue available in June. Edited by Wilson da Silva, President of the World Federation of Science Journalists, the 112-page glossy magazine is being produced by a new publishing company set up by Dr Alan Finkel, an Australian inventor and biotechnology entrepreneur who founded Axon Instruments.

More information is available at www.cosmosmagazine.com.

Drawing on the past

Academy Fellow Dr Liz Truswell, who works as an artist while continuing to undertake research as a Visiting Fellow in the Department of Earth and Marine Sciences at the Australian National University, held her first solo exhibition at the ANCA Gallery (Australian National Capital Artists) in Dickson, ACT in February, where twenty-four of the thirty works on display were sold.

These works drew substantially on Liz's work as a palaeontologist, taking as their starting point life forms that inhabited 'deep time'. The works are a celebration of past life – its abundance, bizarre nature, diversity and fragmentary record. Liz describes her approach to her art for us:

'As an artist and a scientist, I work from a conviction that art and science are closely linked; that each is a different way of responding to the natural world. The set of drawings in the exhibition were informed by the diverse imagery of Earth history and its life forms. The natural media of charcoal, and clay pigments derived from the local region, seem most appropriate for this task.

'The exhibition took as its themes, first, the trilobites, whose lobed, segmented bodies are often used as the emblem, the symbol of palaeontology. They were present in abundance and



Batocara, one of the works on display at the exhibition.

diversity in the seas of 250 to 500 million years ago.

'The lamp-shells, or brachiopods, form a second theme. Their complex internal structures – lophophores – serve as feeding mechanisms. These are reminiscent of landscapes, but are not static, and embrace a sense of continuous movement.

'The tough woody holdfasts of the giant kelps form a third thread; these "not-quite-fossils" are a characteristic of beach litter on our southern coasts.

'Some of the drawings include text. In these cases I refer to the formal text of palaeontology. This has its own traditions, forms of expression, and assumptions. By bringing the formal languages of science and art together I am hoping that each will challenge the other.

'In a long working life as a palaeontologist, I have spent much of that working with time, in deciphering something of the changes that are a fundamental part of the natural world. These drawings reflect my own response to the strangeness of life, to passages of time incomprehensible to human imagination, and to the fragmentary nature of human understanding'.

Liz Truswell can be contacted by email at liz.t@effect.net.au.

Science meets Parliament – 2005

The Academy is a long-term major sponsor of the Science meets Parliament event hosted by the Federation of Australian Societies and Technological Societies (FASTS). The sixth Science meets Parliament, held on 8-9 March, was a record breaker on all accounts. It drew the largest participation by scientists, technologists, parliamentarians and sponsor nominees since the event was launched in 1999. The dinner, held in the Great Hall of Parliament House, was attended by 310 guests, including 56 parliamentarians and the National Press Club luncheon address by Science Minister, Dr Brendan Nelson, was one of the largest associated with Science meets Parliament, with 270 people attending. Dr Norman Swan ran a hypothetical on Australia's preparedness for dealing with a viral pandemic (an idea put forward by the Academy). The panel included



Representing the Academy at Science meets Parliament were (from left) Professor Sue Serjeantson, Professor Tony Klein (Chair, Victorian Regional Group of Fellows) and Professor Elspeth McLachlan (Chair, NSW Regional Group).

the Minister for Health and Ageing, Tony Abbot, Shadow Health Minister, Julia Gillard, and leading health professionals. The hypothetical has since proved influential in raising media focus and public debate. A transcript of the hypothetical is available at www.fast.org. In October

2004 the Academy held a High Flyers Think Tank on emerging diseases, which also provided a timely and relevant contribution to this topic. The proceedings of the Think Tank are available at www.science.org.au/events/emergingdiseases.