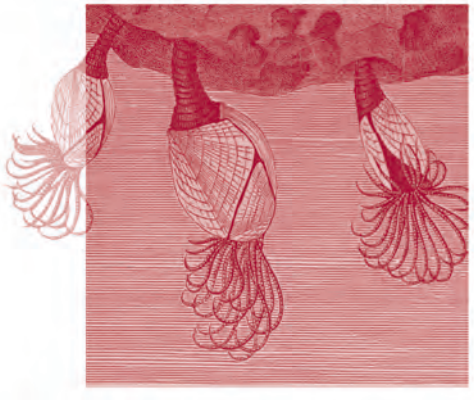
The LINNEAN SOCIETY of London

The Linnean



NEWSLETTER AND PROCEEDINGS OF THE LINNEAN SOCIETY OF LONDON

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A forum for natural history

THE LINNEAN SOCIETY OF LONDON

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THE LINNEAN

Newsletter and Proceedings of the Linnean Society of London

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Edited by Brian G Gardiner

Editorial

In the January *Linnean* we noted that February 12th 2009 was the 200th anniversary of Darwin's birth. However, we have to wait until the 24th November for the 150th anniversary of the publication of *The Origin of Species*!

This issue contains two articles celebrating Darwin's birthday. The first explains how Darwin wrote to J.D. Hooker on July 22nd 1879 "The rapid development as far as we can judge of all the higher plants is an abominable mystery". It also notes that Darwin was concerned with the fossil record in which the appearance and rapid diversification of the angiosperms seemed to be in conflict with the gradual change implicit in his concept of natural selection. Also in his letter to Hooker (1879), Darwin notes "Sapora believes that there was an astonishing rapid development of the higher plants as soon as flower-frequenting insects were developed and favoured inter-crossing." In conclusion, the author notes that Fellows interested in the problem of the rise of the angiosperms can register for a two-day meeting at the Royal Society on 11th-12th May, entitled "Darwin and the evolution of flowers".

The second paper, "Darwin and plant fossils" gives a review of the accounts of plant fossils he saw and collected during his voyage on the Beagle, taken from his published books, his notebooks and his letters.

BRIAN GARDINER

Society News

As the clock struck 12am on 1st January, the world braced itself for another year, and many in a variety of learned and scholarly institutions across the world, braced themselves for Darwin200!

The hundreds of lectures, workshops, seminars and exhibitions which have already taken place internationally and the many more planned for during the year, combined with the publications, TV and radio broadcasts, statues and stamps have highlighted and will continue to emphasise the seminal contribution of one of the Society's most famous Fellows. It is no surprise then that the number of requests to the Society for the use of our Darwin pictures has significantly increased in the last 3 months!

On February 12th 2009, we celebrated Darwin's 200th birthday with the presentation of the Darwin-Wallace medals, a wonderful opportunity to acknowledge the important contributions of both Darwin and Wallace and celebrate the achievements of 13

Following the 221st Anniversary Meeting on 21st May 2009,
the President and Officers of the Linnean Society of London would like to invite you to join them and the medal winners for dinner.
£35 per person
To register to attend please visit *www.linnean.org* (under Upcoming Events) or contact Kate Longhurst
Email: *kate@linnean.org* Tel: +44 (0)20 7434 4479 ext. 11

scientists who had made "major advances in evolutionary biology since 1958". A more detailed account of this very special occasion can be found on page 3. As I write we are looking forward to our continued involvement in the global Darwin200 celebrations when we welcome Professor James Moore to the Society on March 19th 2009 to speak on "Darwin's Sacred Cause". Further meetings are also planned for later in the year: "The 'irritable power' of carnivorous plants: Mary Treat, Charles Darwin and the language of flowers", a lecture organised by Dawn Sanders FLS on 17th September 2009; "The Poetry of Science: creative writing and the artistic naturalist", a lecture by Kelley Swain, author of *Darwin's Microscope*, on 5th November 2009; and "The Galapagos Archipelago: a living laboratory", a scientific meeting organised by Sandra Knapp FLS, Sarah Darwin FLS and the Galapagos Conservation Trust on 17th November 2009. In December, as Darwin200 draws to a close, we will celebrate another special anniversary, the 250th birthday of the Society's Founder, Sir James Edward Smith – watch this space for more information!

We have been delighted to welcome large numbers of Fellows and visitors to our evening meetings since the turn of the year. Over 150 people packed both the Meeting Room and the Library for the meeting in January at which Mr John Griffiths FLS gave an entertaining and highly informative lecture on "Tea: the drink that changed the world", and the meeting in February when Mr Norman Carreck explored the highly topical issue of "Declining bee populations: what are the causes?" Our new Programmes Brochure incorporating meetings taking place between April and July accompanies this issue of *The Linnean*. Please note in particular, the Second Annual Biodiversity Policy Lecture to be held on April 16th 2009, when we will welcome Professor John Beddington CMG, FRS, Government Chief Scientific Officer and Head of the Government Office for Science, to speak on "Biodiversity in a Changing World". This event is free, but registration is essential. I'd also like to take this opportunity to highlight the meeting to be held on July 3rd 2009 at which we will celebrate the life of Dr John Marsden MBE Hon FLS and in particular his outstanding contribution to the Society, as our Executive Secretary; registration for this event is, again, free but essential.

The Society's new publication *Letters to Linnaeus* was launched to a large audience at a meeting on March 3rd 2009. Speakers, including the Editors of the publication, Dr Sandra Knapp and Professor Quentin Wheeler, read extracts from some of the letters within this innovative and thought-provoking book. Copies can be ordered through our website.

We also welcomed the introduction of another publication, the Society's new magazine, *PuLSe*; many thanks to Leonie Berwick and Kate Longhurst for bringing this to fruition. One of the aims of *PuLSe* is to provide a means of information exchange and comment within the Fellowship and I'm delighted that we have already received many positive comments and suggestions. Please do continue to send these to Leonie (*leonie@linnean.org*).

I end this Society News with a "Welcome!" to new Colleagues and also some words of thanks and farewell. Lucy Gosnay joined the staff-team in February bringing both library cataloguing and conservation skills. She is currently working with Lynda in the library and will then move to work with Janet cleaning the Smith Herbarium specimens. Carole Hunt joined us on March 16th 2009 as Administrative Assistant,

working with Victoria and Kate in the main office. We warmly welcome both Lucy and Carole. Following three extremely busy years, characterised by significant activity and achievement (see page 10 for a review), we will say farewell to Elaine Shaughnessy as a member of the staff team, at the end of April. Thank you Elaine; we look forward to your continued involvement as a Fellow!

If you have not already done so, please do join our "Linnean News" mailing-list to stay up-to-date with events held at the Society and other events involving our Fellows. I look forward to welcoming you to the Society for a future meeting and to hearing your thoughts and suggestions for future Society activity.

RUTH TEMPLE

Executive Secretary

Presentation of the Darwin-Wallace Medals 2008

The presentation of the Darwin-Wallace Medals 2008 took place on February 12th 2009 in the Society's rooms. The President of the Linnean Society, Professor David Cutler opened the meeting with words of welcome and congratulations to the medallists and gave a brief presentation about the history of the medals and the previous recipients of medals presented in 1908 and 1958. These included Wallace himself who received the only gold medal in 1908. The Executive Secretary, Dr Ruth Temple read the citations for the 13 medallists and the President presented the medals to Professor Nicholas

The Darwin-Wallace Medallists 2008 (L-R): Professor Joseph Felsenstein, Mr Julian Maynard-Smith, Professor Nicholas Barton, Professor Mohamed Noor, Professor Linda Partridge, Professor Mark Chase, Professor Rosemary Grant, Professor Peter Grant, Professor Lynn Margulis, Professor H Allen Orr, Professor James Mallet, Professor Bryan Clarke, with Professor David Cutler, President of the Linnean Society of London.

Barton FRS, Professor Mark Chase FRS, FLS, Professor Bryan Clarke FRS, FLS, Professor Joseph Felsenstein, Professor Peter Grant FRS, FLS, Professor Rosemary Grant FRS, Professor James Mallet FLS, Professor Lynn Margulis FLS, Professor Mohamed Noor, Professor H Allen Orr and Professor Linda Partridge FRS.

The Society was delighted to welcome Mr Julian Maynard-Smith to receive the medal on behalf of his father, the late Professor John Maynard Smith. Dr Ruth Temple received the medal awarded posthumously to Professor Stephen Jay Gould and this will be forwarded to his family.

Professor Mohamed Noor made the response on behalf of the medallists and his speech is reproduced in full below. The meeting culminated in a wine reception, followed by a dinner for medallists and guests of the Society at the Royal Overseas League, Park Place.

Response by Professor Mohamed Noor,
Associate Professor, Duke University

'First and foremost, let me start by expressing our sincerest gratitude to the Linnean Society for bestowing these awards upon us. We've all grown up reading and being strongly influenced by the works of the 1908 and 1958 awardees, and it is truly humbling to be considered alongside such an illustrious group. Indeed, I would add that I am personally humbled to be considered alongside my 2008 awardee colleagues, as well as the many other outstanding researchers including both you in the Linnean Society and others in the field at large who made our research possible. We are in your debt, and we thank you.

I was asked to comment briefly on the status of the study of evolution today. It's helpful to think about what the world was like (and how it was different from today) 50 years ago, so I'll do that, comment on changes that have happened since, and finally speculate on where we might go next.

50 years ago:

- Commercial jets had been in existence only 10 years
- Computers were the size of whole rooms, they used vacuum tubes, and they were used to monitor the very first artificial satellite, yet these computers had less memory than my watch
- Today's everyday words like cellphone & e-mail did not exist
- And Barack Obama had not yet been born

What about within evolution and related fields?

- The double-helix structure of DNA had only been known for 5 years
- There were ongoing arguments about whether genetic variation was something actively maintained in a population
- Evolutionary journals were publishing elegant laboratory and field-based research on hybrid zones, mimicry, and responses to natural or artificial selection
- and of course, peppered moths in Britain were still black

So, what has happened since?

Clearly, new understandings of evolutionary pattern and process have come from flashes of insight and synthesizing new data with old.

There have been elegant and very productive continuations of many of the same types of research as done up to 1958: including field-based studies of responses of natural populations to disturbance, inferences of evolutionary processes from biogeographic patterns, laboratory evolutionary genetic studies, etc. Some traditional model systems have continued to provide us with many insights, not the least of which would be Darwin's finches, but also various fruitfly and mimetic butterfly species. Some other species have been more intensively studied, such as land snails and monkeyflowers, and new molecular genetic models have emerged such as *C. elegans* worms and *Arabidopsis thaliana* weeds.

However, I would argue that three major innovations stand out as having played a major role in driving progress in understanding evolution these past 50 years. First, we've seen the rise of the field of phylogenetic systematics. We now know that physical or DNA-sequence similarity does not necessarily demonstrate close relationship, and we apply quantitative formulae to sort relationships using shared-derived characters in particular. This field also heralded the application of model-based statistical methods for inferring species relationships, including both Bayesian and maximum likelihood based approaches. Overall, phylogenetic systematics is thriving and providing an irreplaceable framework that essentially didn't exist for understanding how and when evolutionary processes operated in the past.

A second major innovation has been the explosion of computational power and availability. We can now apply approaches that would have seemed absurdly difficult a generation ago. This explosion has allowed for extensive hypothesis-testing across all areas of evolutionary biology (and indeed biology in general) and has generated new predictions to be tested through field or laboratory observations. It allowed the birth of the disciplines now called "bioinformatics" and "population genomics".

Finally, and relatedly, we have all witnessed the amazing growth of the field of genetics. These past 50 years have seen examinations of protein diversity by electrophoresis, succeeded by protein sequencing and DNA sequencing. The invention of PCR revolutionized all areas of biology in the 1980s, and within evolutionary biology, allowed for detailed molecular evolutionary studies of DNA sequences to be possible by the masses rather than the few. More recently, we have now acquired access to organismal genotype at its finest degree: we have assembled and annotated full genome sequences – a feat inconceivable just 20 years ago. Best of all, this is now possible even for non-model systems, and at a price approaching affordability. While we may not yet know the meaning of all the information we can acquire, we can, essentially, get an organism's complete genotype to study.

Obviously, there have been other conceptual advances as well, including the porous nature of some species boundaries, the ubiquity with which selection acts within species and forming new ones, and more refined understandings of various patterns & processes ranging from sexual selection to paleontological trends.

All these advances beg the question of what's to come? Surely we shall behold new insights and continuations of previous productive lines of research. But what will be different?

First, the world is a lot smaller now than it was: many of us have co-authored papers after extended interactions with scientists we've never seen in person. Some may feel that never seeing these colleagues is sometimes a good thing (ha ha). Sharing of data and ideas will only become easier and easier, and synergies will grow that would have been impossible in the preceding 50 years.

But I think the biggest change may be a renewed emphasis on natural history. On the one hand, it's wonderful to have access to complete genotypes, but fully understanding fitness effects requires observing organisms carefully in their natural environment, much in the spirit of what Darwin and Wallace themselves did, as well as several of their successors and several people here in this room. Natural historians have watched the growth of genetics in awe these past 20 years, but I suspect that geneticists will be the ones watching natural historians in awe in the succeeding 50 as these natural historians use classical and novel techniques to interpret the overabundant genetic information. We may find more natural historians very much following in Darwin's and Wallace's footsteps as future Linnean Society Darwin-Wallace medal awardees. This is also very much in the spirit of your honorable society, which notes in its first charter the purpose of ***The cultivation of the Science of Natural History in all its branches***.

I thank you all again for your time and for this wonderful honor, and we are pleased you'll be honoring more scientists' work by shifting to a yearly award. Thank you.'

Citations of the medallists

Professor Nicholas Barton FRS

Professor Barton's early research was on the narrow zones of hybridization that subdivide many populations; this involved work on a variety of species, including grasshoppers, butterflies, and toads. More recently, his research has been mainly theoretical and aimed at understanding the influence of selection on complex traits, models of speciation, the evolution of sex and recombination, and the coalescent process. He has co-authored a textbook, *Evolution*, which aims to combine molecular and organismal aspects of the subject. He has worked at Department of Genetics, University College London (1982–1990), and at the Institute of Evolutionary Biology, University of Edinburgh (1990–2008), and has recently moved to the Institute of Science and Technology in Austria.

Professor Mark Chase FRS, FLS

Over the past 15 years Professor Chase has inspired and led the team that has produced two editions of the new classification of angiosperms that has revolutionized thinking about the evolutionary history and relationships of flowering plants. This has had profound implications for the classification and systematic study of the group, *inter alia* identifying the paraphyly of the dicotyledons and providing a robust phylogeny and new classification for the monocotyledons. He has also taken a lead in the study of the Orchidaceae, one of the largest families of flowering plants and one of the most diverse. He has been one of the four editors and compilers of the monumental

Genera Orchidacearum project which involves the collaboration of almost 100 scientists worldwide, a model for large scale collaborations on difficult groups of organisms, as indeed is the Angiosperm Phylogeny project.

Professor Bryan Clarke FRS, FLS

Professor Clarke has had a long and distinguished career as a population geneticist and evolutionary biologist. He is best known for his work on frequency-dependent selection, in contexts as diverse as host-parasite interactions and the demography of snails. His research on snails in Moorea, Tahiti and other islands, combined with behaviour and genetics research in the lab, is a classical study of speciation and adaptive diversification. It led to the founding of breeding stocks in the laboratory at a time when the natural populations were declining to extinction. He is a leader in conservation genetics of endangered species.

Professor Joseph Felsenstein

Professor Joseph Felsenstein has made seminal contributions to molecular phylogenetics, population genetics and evolutionary biology. His contributions include development of likelihood algorithms for phylogeny reconstruction and introduction of the bootstrap to assess phylogenetic accuracy. These have played a pivotal role in transforming the field from one of philosophical arguments to one of rigorous model-based statistical inference. Felsenstein has also made fundamental contributions to theoretical population genetics, on the effects of recombination and sex and on estimation of population genetics parameters from a DNA sample under the coalescent model. His work on comparative methods is widely used to infer correlation of character evolution. Felsenstein's computer programs have enabled these methods to be widely applied to real data analysis.

Professor Stephen Jay Gould FRS

Stephen Jay Gould (1941-2002) was among the best known and widely read scientists of the late 20th century. A paleontologist and educator at Harvard University, Gould made his largest contributions to science as the leading spokes-person for evolutionary theory. His monthly columns in *Natural History* magazine and his popular works on evolution have earned him numerous awards and one of the largest readerships in the popular-science genre – penning altogether over 25 successful books throughout his career. For more than 30 years Gould served on the faculty at Harvard, where he was Alexander Agassiz Professor of Zoology, Professor of Geology, Biology, and the History of Science, as well as curator for Invertebrate Paleontology at the institution's Museum of Comparative Zoology.

Professor Peter Grant FLS FRS and Professor Rosemary Grant FRS

Peter and Rosemary Grant have been studying Darwin's finches on the Galápagos islands since 1973. Their fieldwork is designed to understand the causes of an adaptive radiation. It combines analyses of archipelago-wide patterns of evolution with detailed investigations of population level processes on two islands, Genovesa and Daphne. Their work is a blend of ecology, behaviour and genetics. They have collaborated with investigators to estimate phylogenetic relations among the species of finches and their relatives on the continent and in the Caribbean, and to identify the molecular mechanisms

involved in the development of beaks that vary so conspicuously among the species. Their earlier work has been published in two books. A third book, entitled "How and Why Species Multiply", was published by Princeton University Press in 2008.

Rosemary was initially trained at the University of Edinburgh, received a PhD degree from Uppsala University, and was a Research scholar and lecturer with the rank of Professor in the Department of Ecology and Evolutionary Biology at Princeton University until she retired from teaching in 2008. Peter is the Class of 1877 Professor Emeritus in the same Department, having trained at Cambridge University and the University of British Columbia. Before joining Princeton in 1986 he taught at McGill University and the University of Michigan.

Professor James (Jim) Mallet FLS

Professor Mallet runs one of the most influential evolutionary genetics laboratories in the country. A genuinely broad natural historian, he integrates a wide range of field and genetic data in his studies of speciation in insects, particularly Lepidoptera. His ideas on mimicry, the nature of species, ecological speciation, hybridisation, and the shifting balance theory based on Lepidoptera have always been controversial, but has sparked a great deal of active debate which is still ongoing. His breadth of interests have prompted a wide range of collaborations, enhancing in particular his co-evolutionary studies. He has also been an unstinting advocate of systematic biology as an essential framework for all meaningful evolutionary studies, actively contributing to organisations such as the Royal Entomological Society and the Linnean Society and is co-director of the London-based Centre for Evolution and Ecology.

Professor Lynn Margulis FLS

Professor Margulis is a Distinguished University Professor in the Department of Geosciences at the University of Massachusetts-Amherst. An "evolutionist", not an evolutionary biologist, she has detailed the multiple symbiotic origins of nucleated cells from bacterial antecedents (SET or Serial Endosymbiosis Theory). Presented as *Origin of Mitosing Cells* (1966), she developed the idea of *Symbiosis in Cell Evolution: Microbial communities in the Archean and Proterozoic eons*, 3rd ed., in her book-length monograph. She continues to pioneer the recognition of symbiogenesis in the origin of eukaryotic species and more inclusive taxa. With her students and colleagues in the field and laboratory she investigates microbial symbioses, especially bacteria and protoctists under microoxic conditions. A co-founder of two international societies Evolutionary Protistology (ISEP) and Symbiosis (ISS) and a member of the US National Academy of Science, she received a National Medal of Science from President Clinton in 1999.

Professor John Maynard Smith FRS, FLS

Professor Maynard Smith was by far the most influential British evolutionary biologist of the second half of the 20th century. Architect of the world-leading University of Sussex school of 'mathematical selection', he elevated to a higher plane the mathematical population genetics approaches developed in the UK by RA Fisher, and then compounded this remarkable achievement by applying the previously economically focused game theory to evolutionary problems. These breakthroughs prompted many high-impact papers (leading to a relatively early FRS) and several

technically rigorous but readable books. Unusually among population-level thinkers, Maynard Smith was also deeply interested in profound evolutionary transitions, culminating in *The major transitions in evolution* (1995). His exceptional abilities and egalitarian worldview earned him great affection from evolutionary biologists worldwide.

Professor Mohamed Noor

Professor Noor specialises in *Drosophila* evolution and is currently a Professor and Associate Chair at Duke University. He stands out as one of the first scientists to demonstrate "speciation via reinforcement" experimentally; i.e. that mating preferences diverge as a result of natural selection against deleterious hybridization. He has more recently developed a new model of speciation that predicts how chromosomal rearrangements can trap divergently selected variation. On the basis of his work with *Drosophila*, this model is now accepted as a likely important phase of speciation. In 2007, he contributed to the publication on sequencing the genomes of 12 *Drosophila* species, work that was published in *Nature* and that has become the benchmark for the emerging field of comparative genomics. He holds or has held many honours and editorial posts, such as editor for the international journal *Evolution* and has authored close to 100 refereed publications.

Professor H. Allen Orr

Professor Orr is University Professor and Shirley Cox Kearns Chair of Biology at the University of Rochester. He is an evolutionary biologist whose research focuses on speciation and adaptation. His speciation work has primarily involved studies of hybrid sterility and inviability. These studies have included genetic analyses of Haldane's rule, comparative studies of patterns that characterize speciation, and the molecular identification of genes that cause reproductive isolation. He is the co-author of *Speciation* (with J. A. Coyne). His adaptation work has involved mathematical studies of patterns that may characterize adaptive evolution. Professor Orr also frequently contributes book reviews and essays to publications including *The New York Review of Books* and *The New Yorker*. He has been the recipient of a Guggenheim Fellowship, a David and Lucile Packard Fellowship, and the Dobzhansky Prize from the Society for the Study of Evolution.

Professor Linda Partridge FRS

Professor Partridge has used the model organism *Drosophila melanogaster* to investigate the evolution of a wide variety of physiological traits involved in adaptation. Her research is directed to understanding fitness-related traits, particularly ageing and body size, and has brought new insights into how these traits influence organisms throughout their lifespans. She is the recipient of many awards, and has been awarded the CBE for services to evolutionary biology. She is the director of the UCL Institute of Healthy Ageing, and has recently become the director of a new Max Planck institute on the same topic. Her current research focuses on physiological mechanisms that force organisms to make trade-offs, such as that between high nutrient intake and high reproductive rate, on one hand, and slow ageing on the other.

The Linnean Society Review

May 2006 – March 2009

The years 2006–09 have been exciting and productive for the Society. Major high points include the highly-enjoyable Linnaean Tercentenary celebrations, the beautiful refurbishment of the Society's Rooms and creation of a dedicated room for the Smith Herbarium, the digitisation of the Society's taxonomically-important Linnaean Collections, and the publication of work of significant scientific value in our journals and publications. The Society's core purpose is to promote knowledge and learning in the biological sciences, encouraging and communicating scientific advances through our fellowship together with our journals, publications, meetings and website. To strengthen our purpose, taking account of the changing climate and the acquisition of additional space, we have developed the new *Strategic Plan 2008–12* to ensure we continue to deliver our core strengths as well as having the flexibility to adapt to meet the needs of the next generation of biologists and the wider community.

We have significantly raised the profile of the Society's activities, increasing media awareness and impact and have developed our outreach activities to make the Society more accessible. We are delighted to now see our Rooms full to overflowing on meeting nights and to see our events programme highlighted in the many web-based information services. Internally, the Society's staff have benefited from upgraded computer software and systems throughout, enabling us to provide enhanced services to our fellowship. Information on the Society's portrait collection is being gradually added to the Library's extensive online catalogue and we have begun to build a digital photographic resource to support the Library's extensive photo collection. Wireless broadband is now available throughout the building.

We have also reached the second phase of our fundraising campaign aimed at increasing resources available to the Society to enable us to undertake our capital development projects, to digitise our remaining collections, and to increase our grant-giving capacity for our awards and grants programme. The Society's progress has been regularly recorded in our annual reports and in *The Linnean* which are all available online on the Society's website *www.linnean.org*. It is exciting to look at some of the overall results to see the highly-rewarding impact that many of these activities are having.

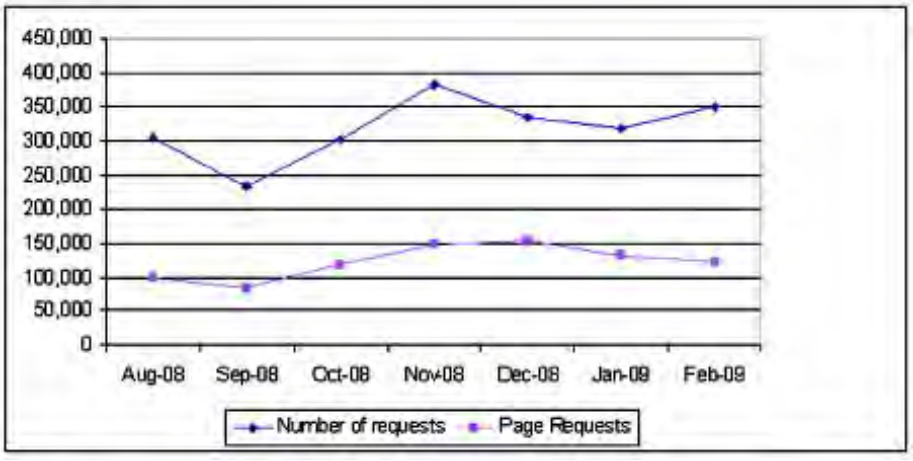
The Society's vision for the CARLS programme (Computer Access to the Records of the Linnean Society) is to make the scientifically and historically important collections of the Society available electronically. The CARLS projects have been successfully implemented through the work of our Fellows and joint-institutional partnerships and through the generosity of our donors and fellows, as well as through specifically-reserved project funds. In 2007, the Linnaean Typification Project was completed, a joint-initiative with the Natural History Museum, London, to establish type specimens retroactively for the 9,000 plant names of species coined by Linnaeus, culminating with the award-winning publication *Order out of Chaos: Linnaean Plant Names and their Types*, by Dr Charlie Jarvis HonFLS. The Smith Herbarium is the taxonomically important collection of botanical specimens assembled by Sir James

Edward Smith (1759–1828) to preserve specimens sent from botanists and physicians from around the world. To date, of the total 19,948 specimens, 14,230 have now been cleaned in preparation for their digitisation.

In February, the Society launched online the digitised images of the Hymenoptera (bees, wasps, sawflies and ants) from the insect collection of Carl Linnaeus (1707–1778). The 859 Hymenoptera specimens also include specimens from the collection of the Society's founder and first President, Sir James Edward Smith (1759–1828) who purchased Linnaeus' collection in 1784, adding his own to it. Each specimen was digitally imaged by specialists at the Natural History Museum in London. The resulting images are of superb quality. Access to the system is through the Linnean Society website and can be found at *www.linnean-online.org*. The supporting descriptive data were prepared by Dr Mike Fitton of the Natural History Museum, London and Honorary Curator of the Society's Linnaean Insect Collections. This has been integrated into the Society's Repository, developed and hosted by the University of London Computer Centre (ULCC). Some of Linnaeus' "top" Hymenoptera species include: the honey bee, *Apis mellifera* L., the ruby-tailed wasp, *Chrysis ignita* L.; the red tailed bumble bee, *Bombus lapidarius* (L.) (see above) and the hornet, *Vespa crabro* L.

The launch of the Hymenoptera images follows the successful online launch in 2007 of the 14,300 Linnaean plant specimens and in 2008 the 168 fish specimens and the 1,513 specimens of the first group of insects, the Lepidoptera (butterflies and moths). These images have already been accessed from over 45 countries worldwide, underlining their significance as a key resource for taxonomic research. The current favourite searches include the brown trout, *Salmo trutta* L. and the morpho butterfly, *Papilio morpha* L.

Julia Hoare has prepared the figure overleaf which shows that we are receiving approximately 300,000 web hits a month on the digitised collections, and more significantly, around 125,000 page hits, which equates to approximately 12,500 requests a day for information. There has been a substantive increase in data downloads from an initial figure of 1.97Gb to 7.61Gb a month, with researchers spending increasingly more time using and working on the collections. The outstanding success of the digitisation programme making valuable research material freely available clearly indicates that the remainder of the Society's wealth of collections should be digitised. All the Society's digital assets are managed and preserved in our content management system hosted by the University of London Computer Centre.



The Society preserves over 4,000 letters written to Linnaeus from 600 correspondents worldwide, made available online through the international Linnaean Correspondence Project, enabling free global access to this important historical collection. The Society has now also made the collection available through the Linnean Society website *www.linnean-online.org* and included additional material held in the Society's Linnaean correspondence collection. In early March, the Society held a launch for its new publication *Letters to Linnaeus* (see page 17). To celebrate the 250th anniversary of the 10th edition of Linnaeus' *Systema Naturae*, editors Dr Sandra Knapp FLS and Professor Quentin Wheeler FLS asked a wide range of scientists around the world to write a letter to Linnaeus describing his impact on natural science today, resulting in this entertaining and informative volume.

The Linnaeus Link Project is an international collaboration between libraries with significant holdings of Linnaean material, creating a comprehensive, online Union Catalogue of Linnaean publications. This important resource, hosted by the Linnean Society, facilitates research for scholars worldwide, enabling them to identify locations of titles with a single internet search. Already holding records from six major institutions, we are delighted to report that the Society began harvesting the records of The British Library in March.

The Society's impact and outreach has been greatly extended through the successful development and implementation of the communications strategy, taking advantage of a unique period in the Society's history: the celebration of the 300th anniversary of Linnaeus in 2007, the 150th anniversary of the reading of the Darwin-Wallace paper on the theory of evolution in 2008, Darwin200 and the 250th anniversary of the birth of the Society's founder, Sir James Edward Smith, in 2009. We implemented an elegant new design for the Society's products (new brand identity) and developed a new series of communication tools including a new website, online news, press releases, brochures and posters. The new virtual tour of the Society, narrated by Sir David Attenborough HonFLS, will be released on the website shortly. Some of the major highlights include winning the silver-gilt Lindley Medal at Chelsea Flower Show for the Society's exhibit 'Linnaeus' Legacy: 300 years of naming nature' resulting in extensive media coverage, the *Countryfile* programme on the Society, including the judging of their annual

photographic competition in our Library, and collaborating on joint meetings to discuss future conservation priorities and solutions such as the recent meeting on the role of restoration ecology in mitigation of climate change and loss of biodiversity.

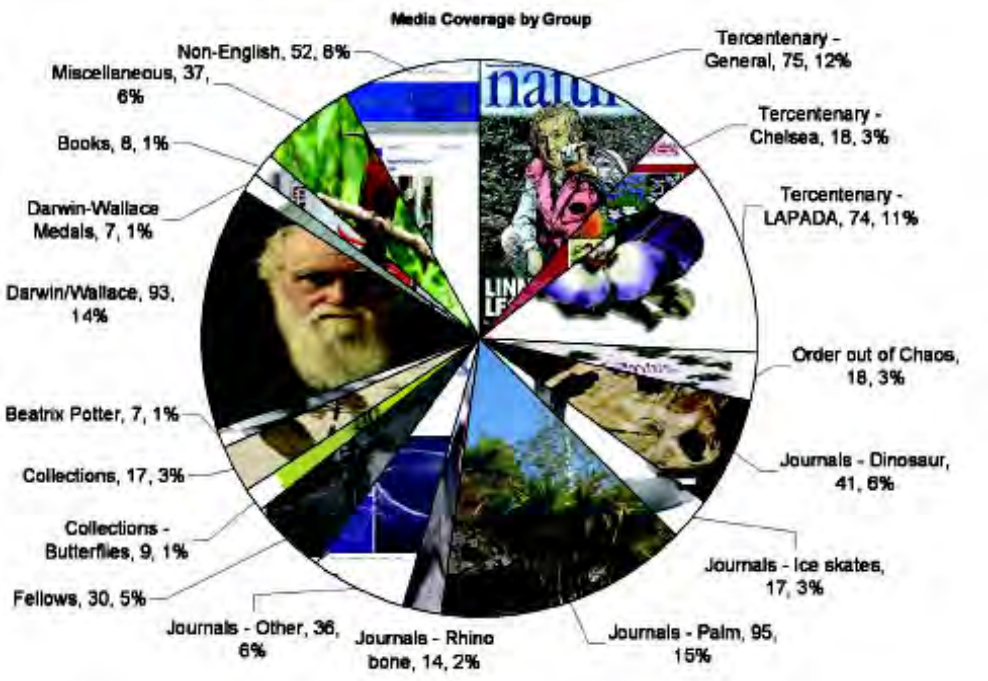
The programme to digitise the backfiles of the five Linnean Society journals, including the *Transactions* and the *Proceedings,* continues to progress well. On completion, this will make the Society's journals available online back to 1791. This exemplifies the considerable achievement of the Society through its joint venture with Wiley-Blackwell in advancing and promoting scientific knowledge within Natural History. We have also worked closely to actively promote outstanding articles in our journals that contribute significantly to the understanding of the natural world, including: the discovery of the largest new species of duck-billed dinosaur *Gryposaurus monumentensis* in the Grand Staircase-Escalante National Monument, Utah; the substantial evidence supporting the theory that the birth of ice-skating using bone skates took place in Southern Finland, where the number of lakes within 100 square kilometres is the highest in the world; and the discovery of a new genus of self-destructive palm, *Tahina spectabilis*.

We have engaged much more actively in joint communication activities with our neighbouring learned societies as part of the Burlington House Centre for Arts and Sciences and in major initiatives such as Darwin200. We have undertaken new ventures such as collaboration on the LAPADA Fine Arts and Antique Fairs and we have found new avenues to promote our meetings and events to attract new, younger audiences who will be leading the way to find solutions to the world's most pressing environmental issues.

The Society has worked to expand its reach and to promote its activities both to the media and through the media. Our Fellows, Officers and staff regularly contribute to radio, TV and web-based communication programmes, we issue regular press releases on activities, and our Library staff frequently contribute material and images to publishing houses and magazines. The overall results show how effective this professional approach has been. In 2007, national and international press coverage came to over 300 articles and in 2008, over 250. By March of this year we have already reached 60 articles. Kate Longhurst has designed the chart overleaf to show the breakdown of the coverage.

All these activities strongly positioned the Society to develop its £2.7 million fundraising campaign for its capital development programme, further digitisation of its unique collections and the creation of a major endowment fund to support biologists working to further our understanding of the natural world. The conservation and the digitisation of the Linnaean Correspondence and the digitisation of the Linnaean herbarium and insect collections were achieved through the generous grant support of Arcadia (The Lisbet Rausing Charitable Fund) for £500,000, giving the Society the ability to move forward and implement a significant part of its CARLS Programme (2006–8). The Society itself had specifically accumulated funds to support the Typification Project, Linnaeus Link Project and the refurbishment of its premises.

The campaign was launched at the end of 2007 with the Linnaean Tercentenary Appeal to the Fellows. The Society is very grateful to our Fellowship for the £100,879 raised which not only directly supports our development projects but strengthens our



case with external funding bodies. With generous grant support from His Majesty the Emperor of Japan HonMLS and the Worshipful Company of Fishmongers, together with a contribution from the Fellows' Tercentenary Fund, the Society was able to digitise the Linnaean fish specimens in 2008. We have developed a portfolio of case work on the Society's development projects and are now steadily developing and submitting fundraising approaches to appropriate trusts and foundations.

The Society has a remarkable and illustrious history; but it is a history of innovation and, to maintain it, the organisation needs to adapt to meet the needs of the next generation of biologists and the wider community. In developing the new *Strategic Plan*, it was agreed that as well as continuing to maintain its current focus and strengths, the Society must develop new activities in order to retain its position and influence, including a much stronger educational role. The Society is now ready to build capacity to develop the premises to enable it to become an international centre for the science of natural history, strengthen its Fellowship and provide enhanced Fellowship benefits, provide full digital access to its knowledge and collections, and to develop the existing facilities to become fully accessible physically. The *Strategic Plan 2008–12* is available on the Society's website.

Julia Hoare, who has overseen the digitisation of the Linnaean Collections, has successfully completed the bulk of the digitisation programme. She will now be working for the Society on a part-time consultancy basis, giving support for ongoing development. Julia can be contacted at *julia@linnean.org.* My three-year term contract will conclude at the end of April. Development and fundraising activities will be undertaken by our Executive Secretary Ruth Temple at *ruth@linnean.org*. Communication activities are the responsibility of our Communications Manager, Kate Longhurst at *kate@linnean.org* and our Special Publications and Education Manager, Leonie Berwick at *leonie@linnean.org*.

It has been a wonderful opportunity for me to work with the Linnean Society family to work towards the Society's strategic development and to take part in such an important and enjoyable time in the Society's history. As a Fellow of the Society and a member of the Collections Committee, CARLS Steering Committee and the Linnaean Plant Name Typification Project Committee, I had already taken a busy interest in the Society's activities. It was the greatest pleasure to join the Society's staff in 2006 to expand this role and lead the Council's programme for the Society's development. It has been a stimulating and extremely enjoyable time and I should like to thank everyone for the tremendous support and encouragement that I have received during the last three years. Impossible to thank you all personally here, I would specially like to mention the Linnean Society staff, curators and editors who have been so kind, informative, helpful and supportive; the Officers, Council and Committees who have been so willing to give guidance and support; to the Fellows who have sent suggestions and given of their time in editing documents; to Jenny Edmonds and Sandy Knapp for the very happy collaboration on the Linnaean Tercentenary; and to Julia Hoare, with whom I have spent long, happy hours discussing digitisation projects. To David Cutler, Gren Lucas, and Vaughan Southgate, a special thank you for all the advice and guidance you have always unfailingly given. And my warmest thanks to Gina Douglas and John Parmenter, who are not only an unfailing source of advice, inspiration and knowledge, but who have also given me a perfect home in London while I have been working at the Society. I look forward to returning to the Society and seeing many of you soon at the events and festivities planned for the remainder of 2009.

Warmest wishes
Elaine

ELAINE SHAUGHNESSY FLS
Head of Development 2006-9

Library

December 2008–February 2009

In early December, the Society was represented at a book launch at Alfred Russel Wallace's old school in Hertford. We had provided an image of Wallace that was used on the front cover of *Richard Hale School* by Richard Gander and we received a copy of the book for the Library collection.

We occasionally have visits from artists seeking inspiration for their work from within our collections, but just recently we have had quite a flurry of such visits. These have included a ceramicist producing rather striking cups and vases with botanical motifs and a Swedish playwright and choreographer who has been working on giving children access to Linnaeus and his ideas through performance art. We have also had our annual visit from 18 students on the botanical painting course at the English Gardening School. Other group visits have included 19 Texan university students and a small group of scientists from the Swedish Biodiversity Centre.

Several new international partners are currently starting to add records to the Linnaeus Link union catalogue and Ben has been busy liaising with them, checking their records and generally doing everything necessary to ensure that the "harvesting" of their records progresses smoothly. Lucy Gosnay joined the Library team towards the end of February. She has both cataloguing and conservation skills, so for two months she will be helping us to tackle the cataloguing backlog which built up during the renovations and then, at the beginning of May, she will move on to help Janet with cleaning the Smith Herbarium specimens ready for digitisation.

As well as her core work on those specimens, Janet has also been supervising the work of Wende, an MA conservation student, who volunteers with us two days a week. Janet is also working on setting up a priority salvage plan to ensure that, in the event of a disaster, the Westminster fire brigade will know exactly which material we would like rescued as a matter of urgency.

Gina has been concentrating on grant applications recently. We are currently seeking funding for the cataloguing of the correspondence of our founder, Sir James Edward Smith. One of our volunteers, John St Quinton, is constructing a spreadsheet listing the contents of each of the 27 volumes of letters and noting the condition of the manuscripts, so that we have a better idea of the conservation requirements.

Another of our volunteers, Pia Wilson, has now had training in how to catalogue and is contributing to the erosion of the backlog. Her language skills proved invaluable when she took on the cataloguing of a set of Linnaean theses translated into Swedish from the original Latin. Another group of items is ready for cataloguing after a visitor to the Library unexpectedly offered to help us with some accumulated Chinese and Japanese books. They required assessment by someone proficient in those languages before they could be catalogued and she kindly spent an afternoon providing us with enough information to catalogue and classify about a dozen of the works.

We are pleased to report that Hazel Marsden has recently joined the Library volunteer team. She is continuing the work, started by Professor Bell, of transferring our portrait records into the Heritage system. Alan Brafield is rescuing Society archives from the East Basement and sorting and listing them ready to go up into the Tower Archive Room eventually and John Sellick is progressing well with his transcribing of the collections of Swainson and MacLeay correspondence. So, the once "spare" PC in the Library Annexe is "spare" no more – it is occupied every day by one or other of our volunteers adding records to catalogues and databases as more and more of our material is made available online.

LYNDA BROOKS

Librarian

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Correspondence

From: D.T. Donovan Wells, Somerset

Fate of the *Beagle*

In the recent Special Issue 9 of *The Linnean* Gordon Chancellor, in his article on his father's paintings, repeats the belief that the bottom timbers of the *Beagle* are still lying buried under Essex mud.

It was known that after being retired from active service the ship was used as a base for Customs officers. In 2004 there was a media report that a member of St Andrew's University had established that it had been moored in the River Roach near Burnham-on-Crouch, Essex, and used as a residence by Customs officers and their families. He had pinpointed the site and found domestic refuse and children's toys as evidence of the occupation. He also noted that the ship was finally sold for scrap in 1870.

St Andrews researchers, using ground penetrating radar, detected the image of a ship, which they supposed must be the *Beagle*, in an abandoned dock at the site.

Actually the facts had already been recorded by the late Richard Freeman, Darwin's bibliographer, in his book *Charles Darwin. A companion* (1978). Freeman confirms (p.32) the final use of the vessel and sale to Messrs Murray and Trainer for scrap, but adds that it was then towed to the Thames estuary, presumably to be dismantled. I wrote to the St Andrews researcher but did not get a reply. However, no more was heard of the finding of the remains of the *Beagle*.

No doubt the bones of many ships lie in Essex mud but it seems that the *Beagle* is not one of them.

From: R. Elwyn Hughes FLS FIBiol. Caerdydd, Wales CF5 2PU

Many thanks to Professor Mike Claridge for his most readable article 'Alfred Russel Wallace – a Welsh entomologist!' and for his generous references to my earlier studies in this field. May I briefly extend the discussion by adding a few thoughts on a matter which I have discussed in some detail in recent Welsh-language publications – the possible biological implications of Wallace's exposure to, and interest in, the Welsh language.

Wallace's decision to acquire a knowledge of Welsh was apparently, in the first place, a response to problems encountered in his work as a land surveyor which frequently entailed discussions with monoglot Welsh farmers. Later, a more organic relationship emerged – he opted to lodge with Welsh-speaking families during his periods in Powys and in the Neath valley and attended Welsh services at local chapels; his autobiography included a quotation from the Welsh Bible (Psalm 90 – arguably, an overtly 'creationist' statement) 'to illustrate the grand sound of the language'. He commented on the linguistic patterns in Wales and witnessed the on-going tensions in certain areas between the native Welsh-language culture and encroachments by the 'new' English way of life.

Wallace possessed a mind of unusual plasticity and receptiveness and I have suggested that his exposure to, and familiarity with, the Welsh language and its on-going displacement in the Neath valley by the more utilitarian and 'survival-orientated' English culture, could well have provided him with a basis for the development of his evolutionary thoughts. Wallace witnessed, and indirectly commented on, the gradual displacement of a monolingual Welsh culture by the more powerful linguistically English one. Contemporary observers of the changing pattern in the Swansea-Neath area used terms such as 'survival of the strongest' and 'battle for survival' – terms remarkably similar to those adopted by Wallace in presenting his evolutionary theory. These Welsh-English linguistic tensions could well be regarded as the Wallace equivalent of the competitive *laissez-faire* society suggested by some commentators to have facilitated Darwin's formulation of his evolutionary thoughts.

More strikingly perhaps, Wallace, in his earlier surveying work in the neighbourhood of Rhaeadr in Powys, observed, and commented on, the clear-cut demarcation role of the river Wye in separating the virtually 100% Welsh-speaking population on its Western banks from the non-Welsh communities on the Eastern banks – all very much reminiscent of Wallace's later accounts of biological distribution patterns, initially, those of monkeys and butterflies on the two banks of the Amazon and subsequently his more general preoccupation with the biological significance of boundaries.

It is an intriguing thought that such linguistic patterns could well have provided Wallace (albeit subconsciously) with a conceptual template or framework for the formulation of the two mainstream features of his subsequent development as a biologist – his theory of evolution and his extensive biogeographical studies.

Darwin's "Abominable Mystery"

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If you turn up "Abominable mystery" on Google, linked to Darwin, you will find there are some 62,600 references cited. It is perhaps remarkable that this over-quoted remark came not from one of Darwin's many published works dealing with plant science, but from a letter that he wrote to J.D. Hooker, then Director of RBG Kew. On July 22nd, 1879, Darwin wrote: "The rapid development as far as we can judge of all the higher plants within recent geological time is an abominable mystery" (Darwin and Seward, 1903). Botanists have been mulling over the phrase ever since the letter was published, and in this anniversary year the *American Journal of Botany* has devoted the January number to a series of articles on that theme. It appears that any topic that Darwin found "mysterious" must surely warrant further investigation, especially two hundred years after the great man's birth!

The phrase has of course been of particular interest to palaeobotanists, because as Darwin's letter makes clear, he was concerned with the fossil record of the appearance and rapid diversification of the angiosperms. This aspect of the fossil plant record was already evident in Darwin's time, although the picture has become clearer over the intervening century. Most authors have assumed that what concerned him was the relative rapidity of the evolution of the group, its rapid spread and the early differentiation of the main lines within it, which seemed to be in conflict with the slow and gradual change, implicit in his concept of natural selection. In his very thorough exploration of what lay behind Darwin's much-quoted phrase, Friedman (2009) addresses several other aspects of early angiosperm evolution which have been seen by some as part of the mystery. These include not only the rapidity of change seen in the fossil record, but the phylogenetic relationship of the major clades within the angiosperms, the search for the ancestral (gymnospermous) group from which they evolved, and the record of the "first angiosperm". These and other related problem areas have indeed received much attention, most particularly over the last fifty years.

Friedman (2009), having given an excellent review of the historical background to the controversy, argues that Darwin was much more concerned with the general issue of "rapid evolution" than with the angiosperm story itself. He offers the challenging proposition that "Darwin's abominable mystery is not in the final analysis …… about angiosperms *per se*". None the less, as Friedman explains, Darwin was evidently attracted to two processes which he felt might explain the angiosperm mystery. The first of these was his idea that the early – slow – stages of their evolution might have taken place in some remote location where the fossil record, if it had ever existed, has either been destroyed or remains undiscovered. For in a later letter to Hooker, of August 11th 1881 he wrote: "I have been so astonished at the apparently sudden coming

in of the higher phanerogams, that I have sometimes fancied that development might have slowly gone on for an immense period in some isolated continent or large island, perhaps near the south pole" (Friedman 2009). Perhaps that line of thought may have been engendered by Darwin's Galapagos experience of isolated islands as homes of evolutionary innovation and centres of high endemicity.

On a very different tack, Darwin evidently saw some comfort in the role of the dependence of the success of angiosperm biotic pollination on the rise of appropriate insect groups to effect that process. Saporta (1873) had suggested that the rise of the angiosperms was closely linked to the diversification of insects through their role as pollination vectors. In his 1879 letter to Hooker, Darwin stated: "Saporta believes that there was an astonishingly rapid development of the higher plants as soon as flower-frequenting insects were developed and favoured intercrossing" (Friedman 2009). So perhaps the suddenness of angiosperm diversification was the product of biotic pollination – a subject dear to Darwin, and on which he was to publish his famous book in the context of orchid/insect interdependence (Darwin 1877).

The significance of biotic pollination to angiosperm origins and early evolution has been extensively explored, and it seems clear that the adaptations of a coloured perianth, scent and nectar secretion are fundamental features of a large part of angiosperm diversity. But Darwin seems to be aware of the vulnerability of invoking biotic pollination as the key process in achieving rapid evolutionary change. For as he wrote in 1876, "As a large quantity of pollen is wasted by anemophilous plants, it is surprising that so many vigorous species of this kind abounding with individuals should still exist in any part of the world, for if they had been rendered entomophilous, their pollen would have been transported by the aid of the senses and appetites of insects with incomparably greater safety than by the wind…. It seems at first sight a still more surprising fact that plants after having once been rendered entomophilous, should ever again have become anemophilous" (see Friedman and Barrett 2009). The enormous species-richness of the grasses, which appeared relatively late in the evolution of the angiosperms, demonstrates that the switch to anemophily proved to be no impediment to rapid evolutionary diversification.

Despite the research of the last half century, and the greatly expanded fossil record of early angiosperms (Endress & Doyle 2009, Friis *et al*. 2006, 2009, Stockey & Rothwell 2009, Doyle 2008) there still remain divergent views on the issue of "rapidity". Friedman (2009) in his concluding remarks says that "the earliest manifestation of angiosperms, as now understood appears to be significantly less abrupt than that of the fossil record Heer and Saporta described in the 1870s and 1880s". This is clearly true, but perhaps there is nevertheless more to this issue than just tighter definition of what "rapid" means in the context of early angiosperm evolution. Friis *et al*. (2006) state that "it is very clear that the major differentiation of angiosperms took place over a relatively short time during the early Cretaceous. This is clearly recognised in the record of fossil angiosperm pollen, but is also supported by patterns in the changing diversity and abundance of angiosperm reproductive structures through this interval". A similar view is expressed by Stockey *et al*. in their introduction to the *American Journal of Botany* special issue dedicated to the Abominable Mystery. They write: "what looked like a very rapid evolution of modern taxa to Darwin and his colleagues,

we now know was in part a false impression created by uncritical taxonomic assignments. Nevertheless, by any measure, the initial diversification and rise to dominance of angiosperms was still remarkably rapid" (Stockey *et al*., 2009).

So it seems that the mysteriousness of the rise of the flowering plants has not been entirely dissipated. If Fellows of this society are interested to catch up on current views on the matter, there is a two-day discussion meeting at the Royal Society on May 11th–12th on the theme of "Darwin and the Evolution of Flowers". As with all Royal Society discussion meetings, they are free to attend, but pre-registration (on line) is essential. The online registration form, and programme information can be found at: *www.royalsociety.org*.

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Darwin and plant fossils

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Several years ago while researching the history of geoconservation in the UK I came across Darwin's notes on plant fossils that he collected while on the *Beagle*. Darwin's notes and the plant fossils are stored in the Department of Palaeontology in the Natural History Museum, London. Although the specimens have been incorporated into the museum's collections they are still labelled with Darwin's original numbers so they can be related to his notes and then to his written accounts. Table 1 lists the collection giving details of Darwin's numbers, the accession numbers, the sites they were collected from and notes on their identification.

Darwin's collection of plant fossils was clearly a very minor part of his interest while he was on his voyage around the world. Nevertheless, I do find it rather strange that his collection appears to have been ignored, or at the best, overlooked. I have found no reference to his collection or to any of his specimens except in the historical papers by Banks (1971) and Ottone (2005). While his specimens are not the best of their kind, they do have considerable historical significance and deserve to be more widely known.

The Voyage of the Beagle

It is well known that Darwin went to Edinburgh University in 1825 to study medicine but became more interested in marine invertebrates. Moving to Christ's College Oxford with a view to entering the church, Darwin pursued his interests in natural history and became an enthusiast of beetles. Within two years he came under the influence of The Reverend Professor John Stevens Henslow who was Professor of Botany. Henslow was undisputedly the most influential person in Darwin's life, for when Darwin completed his degree in 1831 Henslow persuaded him to study geology and arranged for him to go with Professor Adam Sedgwick on a geological trip to North Wales. This is where he gained his understanding and enthusiasm for geology. Then came the catalyst for Darwin's scientific work. Henslow had been asked to travel on a survey ship, *HMS Beagle*, as naturalist and travelling companion to the captain, Commander Robert Fitzroy. Henslow did not wish to be away for five years on this round the world voyage so he arranged for Darwin to go instead. Darwin would have been well prepared for his observations on geology and palaeontology and on the animals and plants that he would encounter on his travels. He had a working knowledge of invertebrates, fossil vertebrates and plants. He had read the works of the traveller Alexander von Humboldt, the astronomer Sir John Herschel and, most important of all, Charles Lyell's *Principles of Geology* – the book that first championed the idea of gradual change over many years. However, it is undoubtedly the case that his knowledge did not extend very far with fossil plants. It was just over 10 years since Baron E.F. Schlotheim had published his second major work on fossil plants, *Die Petrefactenkunde auf ihrem jetzigen Standpunkte durch die Beschreibung seiner Sammlung versteinerter und fossiler Uberreste des Thier und Pflanzenreichs der*

MUSEUM (DARWIN) NUMBERS	IDENTIFICATION	AGE	LOCALITY	NOTES
V.5141 (574)	Dicotyledenous wood	Tertiary	Parana River, Argentina	Darwin, 1876, p. 335. Small badly preserved piece cut in T.S.
V.5449 (575)	Unidentified piece of water-worn wood	Tertiary	Parana River, Argentina	Darwin, 1876, p. 335. Appears water-worn and badly preserved.
V.478 (831)	Dicotyledonous wood	Tertiary	Uruguay River bed above junction with the river Plata, Uruguay	Darwin, 1876, p. 335
V.5453 (720)	Unidentified wood		Port St. Julian, Patagonia, Argentina	Probably part of 721 which is poorly preserved & unidentifiable
V.5255 (721)	Unidentified wood	?	Port St. Patagonia Julian, Argentina	Poorly-preserved. Slide V.1023 cut from this specimen
V.4896 (975)	Unidentified wood	Tertiary	Santa Cruz, Patagonia, Argentina	Darwin, 1876, p. 381; large piece of wood cut and polished in TS
V.5136 (798)	Unidentified wood	Tertiary	Santa Cruz, Patagonia, Argentina	Recorded Darwin, 1876, p. 381
V.21577 (75425)	*Nothofagus* sp.	Tertiary	Tierra del Fuego	Darwin 1889,
V.21579 (75649)	*Nothofagus* sp.	Tertiary	Tierra del Fuego	Darwin 1889
V.21580 (75649)	*Nothofagus* sp.	Tertiary	Tierra del Fuego	Darwin 1889
V.21578 (347)	*Nothofagus* sp.	Tertiary	Tierra del Fuego	Darwin 1889 (Noted as *Nothofagoxylon scalariforme* in collections catalogue)
V.4787 (348)	Unidentified wood	Tertiary	Coast of Chile, 43°S	Darwin, 1876, p. 391 (Noted as *Nothofagoxylon scalariforme* in collections catalogue) From the coast and covered with barnacles.
V.4791 (579)	Unidentified wood	Tertiary	Nr. Concepción, Chile	Darwin, 1876, p. 398. Sectioned June 1924; structure poorly-preserved
V.5230 (227)	Unidentified wood	Tertiary	Chile	Piece of drifted wood with Toredo worm borings
V.5668 (705)	*Araucarioxylon protoaraucana* Brea	Triassic	Cordillera of Central Mendoza 33°S	Darwin, 1876, p. 527. V.4790, 5668 & V.5841 are all parts on one specimen
V.4790 (706)	*Araucarioxylon protoaraucana* Brea	Triassic	Cordillera of Central Mendoza 33°S	Darwin, 1876, p. 527. V.4790, 5668 & V.5841 are all parts on one specimen
V.5841 (704)	*Araucarioxylon protoaraucana* Brea	Triassic	Cordillera of Central Mendoza 33°S	Darwin, 1876, p. 527. V.4790, 5668 & V.5841 are all parts on one specimen
V.4775 (889)	Unidentified wood	?	Hoonillos, Cordillera, Chile	
V.4785 (91)	Unidentified wood	? Tertiary	?Copiapó Chile	Probably not wood
V.4788 (44)	Unidentified wood	Quatern--ary	Iquique, Tarapacá, Chile	Darwin, 1876, p. 305. (Iquique was previously in Peru).
V.5592 (?443)	*Dadoxylon arberi* Seward	Permo-Carbon-iferous	Illiwarri, New South Wales, Australia	3 slides cut from this specimen; V.5592a - TS, b - TLS, c - RLS.
V.5284 (444)	Poorly-preserved conifer wood	? Permo--Carbon-iferous	Illiwarri, New South Wales, Australia	Small piece, cut and polished showing growth rings
V.5137 (483)	Unidentified wood	Tertiary	Central Plain Tasmania, Australia	Covered with mineral.
V.5287 (484)	Unidentified wood	? Tertiary	Central Plain Tasmania, Australia	
V.4793 (485)	Unidentified wood	? Tertiary	Central Plain Tasmania, Australia	Not very well preserved with mineralization on surface.
V.5138 (486)	Unidentifiable wood	? Tertiary	Central Plain Tasmania, Australia	
V.5236 (?487)	*Cupressinoxylon hookeri* Arber	Tertiary	Tasmania, Australia	2 large & 1 small portions of wood and numerous fragments
V.5651 (488)	Unidentified wood	? Tertiary	Tasmania, Australia	

Vorwelt erläutert, in 1820 and Count Kaspar Sternberg commenced his six volume work, *Versuch einer geognostisch-botanischen Darstellung der Flora der Vorwelt*, which is now considered to be the starting point for modern studies on fossil plants. Only a few parts of Adolphe Brongniart's important three volume work, *Histoire des végétaux fossiles*, were printed before Darwin set off on his voyage. In Britain work on fossil plants was in a "depressed state" according to Edmumd Tyrell Artis when he published his own compendium of British fossil plants *Antediluvian Phytology* in 1825. So there were very few scientific works on plant fossils available to Darwin in 1831. Yet within a few years (1831–1837) came John Lindley and William Hutton's three volume publication on the British fossil flora *The fossil flora of Great Britain*, Henry Witham's (1833) volume on *The Internal Structure of Fossil Vegetables found in the Carboniferous and Oolitic Deposits of Great Britain* and Nicol's work on fossil wood anatomy in the early 1830s showing how to prepare and study fossil wood. Witham's work would have been the most important for Darwin if he had been able to see it. There were 15 beautiful plates of sections showing the internal anatomy of several fossil woods in perfect detail. Witham pointed out that the attention of geologists had been confined to the external form of such fossil plants and explained how he prepared the thin sections by slicing, grinding and polishing. His principal object in publishing was to persuade geologists to pay more particular attention to the anatomy of fossil plants because the works of Cuvier and Buckland on animal life were giving "so many interesting proofs of successive creation". Witham wrote "may we not expect equal pleasure and instruction from an application to the study of these ancient vegetable remains, which, when properly studied will facilitate our knowledge of the forms, characters, and qualities peculiar to each epoch, and of the degree of temperature and humidity which must have existed during each period?".

Even if Darwin did become aware of Witham's work he had no specialist equipment on board the *Beagle* so all he could do with fossil wood was to ship the specimens back to Britain whenever the opportunity arose, for identification by Robert Brown who was Keeper of the Botany Department in the British Museum, London. Darwin set to sea in the *Beagle* on 27th December, 1831 with the object of the expedition being to complete the survey of Patagonia and Tierra del Fuego to survey the shores of Chile, Peru and some islands in the Pacific and to carry out a chain of chronometric measurements around the world. The *Beagle* made its way to South America, via the Canary Islands and Cape Verde, making landfall at Rio de Janeiro in early July 1832. From there the Beagle sailed south to Argentina.

Argentina

The first mention of plant fossils by Darwin occurs in his notes on "Buenos Ayres, the Beagle Channel and Pt. Desire Creek" where he noted silicified (slink fire) wood. (Beagle Field Notebook, page 2b (inside back cover) November 1832.) Later, in his account of the Formation of the Pampas, Darwin (1842) wrote that he had noted the presence of skeletons of Mastadon, shells, teeth of *Mastadon*, *Toxodon* and *Equus*, and fossil wood and wrote:

> *Much silicified wood is found on the banks of the Paraná [near La Bajada and Cavallú (now Paraná and La Paz)] and I was informed that they come out of these lower beds; four specimens collected by myself are dichotyledonous.*

There are now two of Darwin's specimens in his collection that came from this locality (numbers 574 and 575). Other specimens of fossil wood were found on the banks of the river Uruguay above the junction with the river Plata (Darwin, 1876, p. 355). One specimen in the collection, identified as dichotyledonous wood, is from here being Darwin's number 831.

The Beagle sailed to southern Argentina and on 13th April, 1834 anchored within the mouth of the Santa Cruz (Darwin, 1889, p. 182). In his notebook (EH1.15: Valpariso up Aconcagua to St Jago) Darwin wrote on 27th August, 1834:

> *We arrived at Llanos of Guitron, near Porparco. In a valley leading into it, immense quantity of petrified wood like at Pisada, enough to fill a cart, mixed and scattered fragments of porphyries &c.*

His specimens 720 and 721 are from here (Figure 1). Darwin (1842, 1876 p. 361) also referred to finding silicified wood (his specimens 975 and 978):

> *Five miles higher up the valley, and again thirty miles higher up, (that is twenty miles from the nearest range of the Cordillera…) found at both places, but not in situ, quantities of coniferous and ordinary dicotyledonous silicified wood, which was examined for me by Mr. R. Brown.*

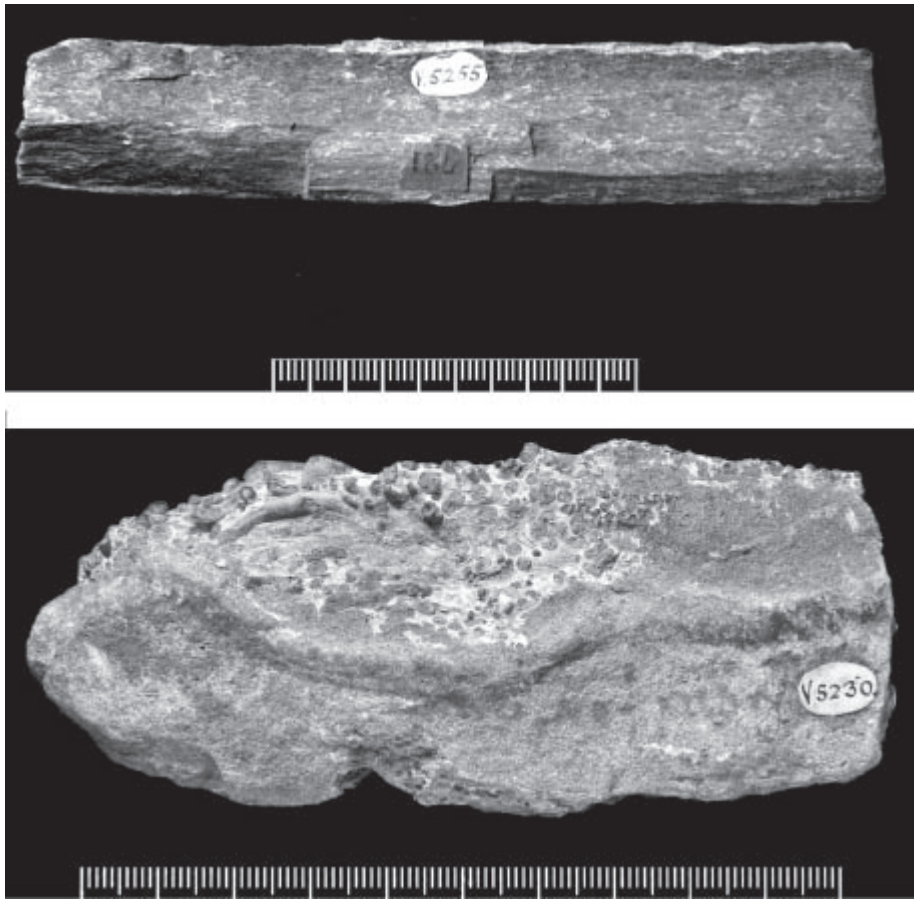

Figure 1. Top: Wood from Port St Julian, Patagonia, V. 5255.
Bottom: Wood from Chile, V. 5230.

In his description of eastern Tierra del Fuego, Darwin described the 200 ft cliffs in Sebastion Bay as part of the Great Patagonian Tertiary formation writing (Darwin, 1889, Chapter XII On the Older Tertiary Formation of Patagonia and Chile, p. 386):

> *In these beds are fragments of wood… Leaves of trees are numerous between the laminae of the muddy sandstone, they belong, as I am informed by Dr J.D. Hooker [who was botanist to the Geological Survey] to three species of deciduous beech, different from the two species which compose the great proportion of trees in this forest-clad land.*

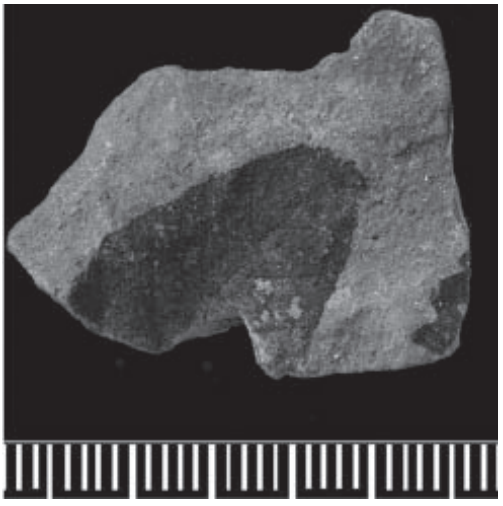

Figure 2. Tip of a leaf of *Nothofagus* sp from Tierra del Fuego, V. 21580.

The leaves are known to belong to the genus *Nothofagus*. Darwin numbered his specimens from here as 75425, 75649 (two have this number and are not parts of one specimen) and 347 (Figures 2, 3). Darwin later visited the Mendoza Province of Argentina from Chile, but as it was an independent Republic at the time of his travels, I have included the information of his travels under Mendoza.

Chile

After the *Beagle* had sailed to the west coast of South America through the Beagle Channel it turned northwards to Valparaiso, before turning southward, for the purpose of surveying the southern part of Chile, the island of Chiloe, and the broken land called the Chonos Archipelago in northern Patagonia. On 21st November, 1834 the *Beagle* anchored in the bay of San Carlos, the capital of Chiloe. Darwin wrote (1876, p. 391):

> *This fine island is about 100 miles in length …. The eastern coast and large parts of the northern extremity of the island are composed of gravel, the boulder formation, and underlying horizontal strata. The latter are well displayed for twenty miles north and south of Castro; they vary in character from common sandstone to fine-grained, laminated mudstones: all the specimens which I examined are easily fusible, and some of the beds might be called volcanic grit-stones. … The sandstone occasionally includes pebbles, and many fragments and layers of lignite; of the latter, some are apparently formed of wood and others of leaves: one layer on the NW. side of Lemuy is nearly two feet in thickness. There is also much silicified wood, both common dicotyledonous and coniferous: a section of one specimen in the direction of the medullary rays has, as I am informed by Mr. R. Brown, the discs in a double row placed alternately, and not opposite as in the true Araucaria.*

Darwin's specimen 348 came from Chiloe and must have been collected from the coast as there are barnacles on it, fitting in with his diary notes (p. 81, 1st December, 1834) of Castro Cliff many rounded blocks of petrified wood.

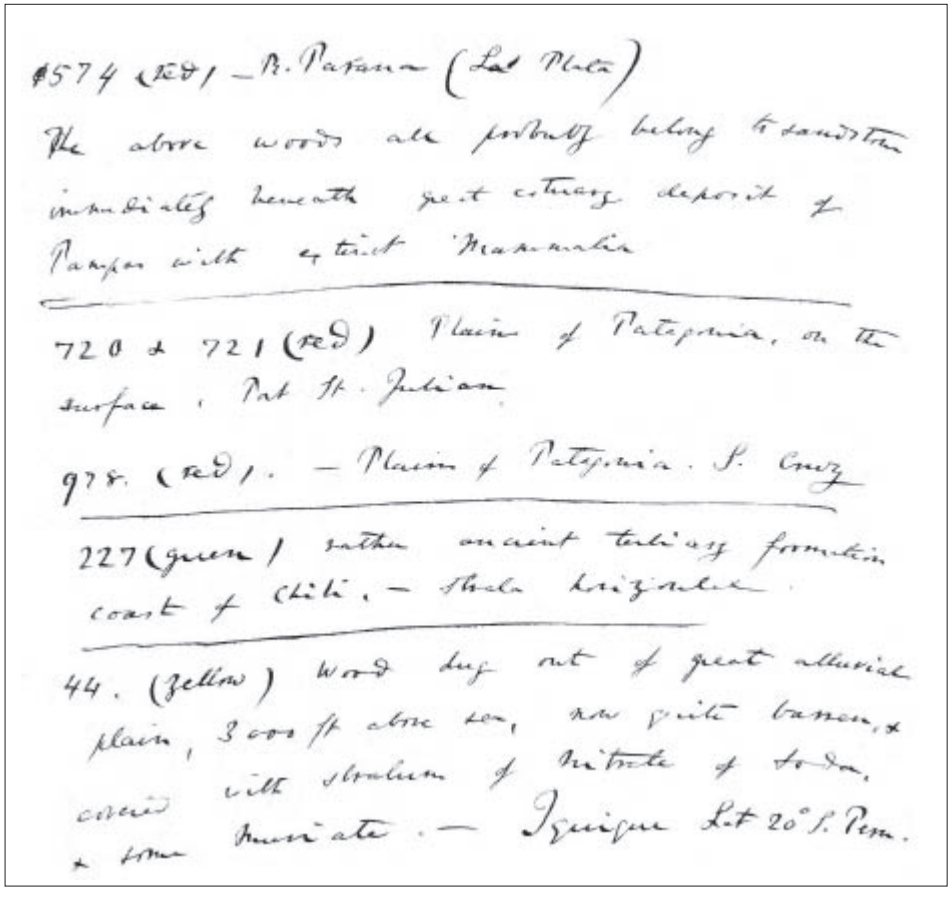

Figure 3. Darwin's notes on his specimens collected in Argentina and Chile.

Darwin also wrote (1876, p.394):

> *The various tufaceous and other beds at this northern end of Chiloe probably belong to about the same age with those near Castro, and they contain, as there, many fragments of black lignite and of silicified and pyritous wood, often embedded close together.*

The *Beagle* called in at Talcuana where Darwin explored before riding with Captain Fitzroy to Concepcion to witness the effects of an earthquake, which Darwin had felt for himself several days earlier (20th February, 1835). Soon afterwards Darwin visited the island of Quiriquina in the Bay of Concepcion, writing that it (1876, p. 398):

> *is formed of various soft and often ferruginous sandstones, with bands of pebbles, and with the lower strata sometimes passing into a conglomerate resting on the underlying metamorphic schists. These beds include subordinate layers of greenish impure clay, soft micaceous and calcareous sandstones, and reddish friable earthy matter with white specks like decomposed crystals of feldspar; they include, also, hard concretions, fragments of shells, lignite, and silicified wood. In the upper part they pass into white, soft sediments and brecciolas, very like those described at Chiloe; as indeed is the whole formation. At Lirguen and other places on the eastern side of the bay, there are good sections of the lower sandstones, which are generally ferruginous, but which vary in character, and even pass into an argillaceous nature; they contain*

> *hard concretions, fragments of lignite, silicified wood, and pebbles (of the same rocks with the pebbles in the sandstones of Quiriquina), and they alternate with numerous, often very thin layers of imperfect coal, generally of little specific gravity. The main bed here is three feet thick; and only the coal of this one bed has a glossy fracture. Another irregular, curvilinear bed of brown, compact lignite, is remarkable for being included in a mass of coarse gravel. These imperfect coals, when placed in a heap, ignite spontaneously.*

Darwin also noted that:

> *During a second visit of the Beagle to Concepcion, Mr. Kent [the assistant surgeon] collected for me some silicified wood and shells out of the concretions in the sandstone from Tome, situated a short distance north of Lirguen.*

There is one specimen of wood in the Natural History Museum collections detailed as coming from the Bio Bio River, near Concepcion (number 579) and another simply as the Chile coast (number 227). Both specimens are structurally poorly preserved and taxonomically unidentifiable.

Darwin wrote up his observations and his thoughts on the geology of this part of Chile (1876, p. 408) including:

> *within a period which cannot be considered as very ancient in relation to the history of the continent, the strata between the Cordillera and the Pacific have been broken up in the same variously-directed manner as have the old plutonic and metamorphic rocks in this same district.*

His observations on the lignite and fossil wood led him to compare the past and present vegetation of the region:

> *the sandstone between Concepcion and Southern Chiloe is everywhere lignitiferous, and includes much silicified wood; whereas the formations in Northern Chile do not include beds of lignite or coal, and in place of the fragments of silicified wood there are silicified bones. Now, at the present day, from Cape Horn to near Concepcion, the land is entirely concealed by forests,which thin out at Concepcion, and in central and northern Chile entirely disappear. This coincidence in the distribution of the fossil wood and the living forests may be quite accidental; but I incline to take a different view of it; for, as the difference in climate, on which the presence of forests depends, is here obviously in chief part due to the form of the land, and as the Cordillera undoubtedly existed when the lignitiferous beds were accumulating, I conceive it is not improbable that the climate, during the lignitiferous period, varied on different parts of the coast in a somewhat similar manner as it now does.*

Mendoza

Darwin made several trips into the interior while the *Beagle* was surveying the coast. On one of his trips in northern Chile in March 1835, Darwin travelled from Valparaiso over the Cordillera range of mountains, into what was then the Republic of Mendoza (now the Argentinean Province of Mendoza). When he was returning to Chile by the Uspallota pass, situated north of Mendoza, Darwin discovered large quantities of petrified trees in the Upsallota range, which is separated from the Cordillera by a long narrow plain or basin at nearly six thousand feet above sea level. He wrote an account of his discoveries here in letters to Professor Henslow in Cambridge that were read at a meeting of the Cambridge Philosophical Society on

16th November, 1835 and printed for distribution among its members on 1st December, 1835 (Darwin, C.R. [1835]. Extracts from letter to Professor Henslow. Cambridge: [privately printed]):

> *In an escarpment of compact greenish sandstone I found a small wood of petrified trees in a vertical position, or rather the strata were inclined about 200 or 300 to one point and the trees 700 to the opposite; that is, they were before the tilt vertical. The sandstone consists of many horizontal layers, and is marked by the concentric lines of the bark (I have a specimen). Eleven are perfectly silicified, and resemble the dicotyledonous wood which I found at Chiloe and Conception: the others, thirty to forty in number, I only know to be trees from the analogy of form and position; they consist of snow-white columns (Like Lot's wife) of coarsely crystallised carbonate of lime. The largest shaft is seven feet. They are all close together, within one hundred yards, and at about the same level; no where else could I find any. It cannot be doubted that the layers of fine sandstone have quietly been deposited between a clump of tree, which were fixed by their roots. The sandstone rests on lava, is covered by a great bed, apparently about one thousand feet thick, of black augitic rocks and aqueous sedimentary deposits; amounting in thickness to several thousand feet. I am afraid of the only conclusion that I can draw from this fact, namely, that there must have been a depression in the surface of the land to that amount. But neglecting this consideration, it was a most satisfactory support of my presumption of the tertiary age of these eastern chain. (I mean by tertiary, that the shells of the period were closely allied to, and some identical with, those which now lie in the lower beds of Patagonia.) A great part of the proof must remain upon my ipse dixit of a mineralogical resemblance to those beds whose age is known. According to this view granite, which forms peaks of a height probably of fourteen thousand feet, has been fluid in the tertiary period; strata of that period have been altered by the heat, and are traversed by dykes from the mass: are now inclined at high angles, and form regular or complicated anticlinal lines. To complete this climax, these same sedimentary strata and lavas are traversed by very numerous true metallic veins of iron, copper, arsenic, silver and gold, and these can be traced to the underlying granite. A gold mine has been worked close to the clump of silicified trees. When you see my specimens, sections, and account, you will think there is pretty strong presumptive evidence of the above facts.*

Darwin also published details of these trees in his geological work (Darwin, 1876 p. 527) giving a detailed description of how to get to the site:

> *For the information of any future traveller, I will describe the spot in detail. Proceeding eastward from the Agua del Zorro, and afterwards leaving on the north side of the road a rancho attached to some old gold-mines, you pass through a gully with low but steep rocks on each hand: the road then bends, and the ascent becomes steeper. A few hundred yards farther on, a stone's throw on the south side of the road, the white calcareous stumps may be seen. The spot is about half a mile east of the Agua del Zorro.*

Then in the account of his travels Darwin (1889, Chapter XV 1835: 30th March, 1835) wrote:

> *it consists of various kinds of submarine lava, alternating with volcanic sandstones and other remarkable sedimentary deposits; the whole having a very close resemblance to some of the tertiary woods on the shores of the Pacific. From this resemblance I expected to find silicified wood which is generally characteristic of the formations. I was gratified in a very extraordinary manner. In the central part of the range at an*

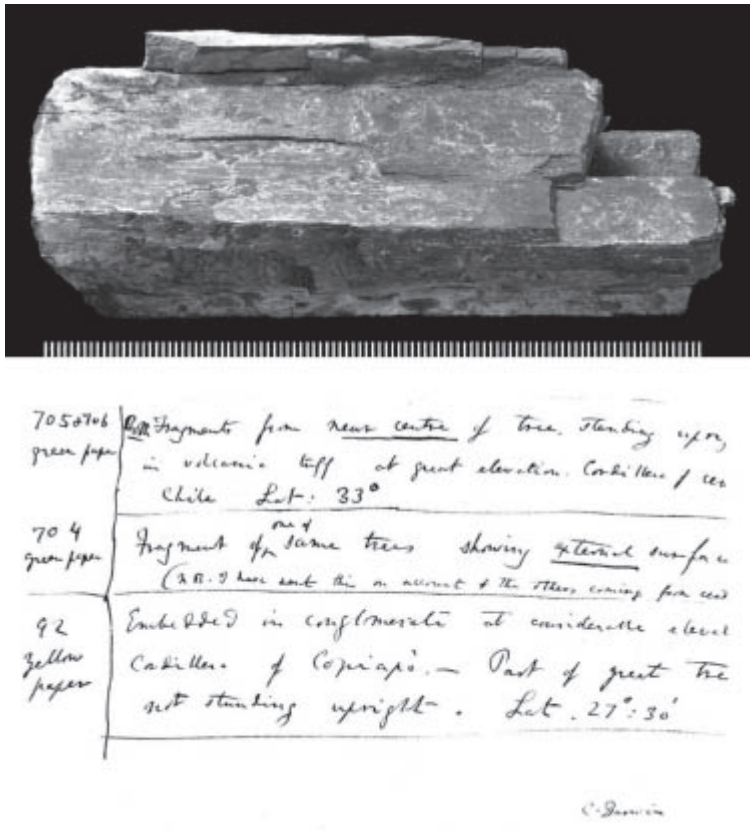

Figure 4. *Araucarioxylon protoaraucana* Brea wood from the Cordillera of central Mendoza, Argentina at 330 S. (Triassic), V. 4790, together with his signed notes on the specimens from Mendoza.

elevation of about seven thousand feet, I observed on a bare slope some snow-white projecting columns. These were petrified trees, eleven being silicified, and from thirty to forty converted into coarsely-crystallised white calcareous spar. They were abruptly broken off, the upright stumps projecting a few feet above the ground. The trunks measured from three to five feet in circumference. They stood a little way apart from each other, but the whole formed one group. Mr Robert Brown has been kind enough to examine the wood: he says it belongs to the fir tribe, with some curious points of affinity with the yew. The volcanic sandstone in which the trees were embedded, and from the lower part of which they must have sprung , had accumulated in successive thin layers around their trunks; and the stone yet retained the impression of the bark.

Darwin's specimens 705 & 706 (Figure 4) are fragments from near the centre of these trees stated in his specimen notes as standing upright in volcanic tuff at great elevation in the Cordillera of central Chile at Latitude 330 south. Specimen 704 is a fragment of one of the same trees showing its external surface with Darwin's specimen notes adding:

I have sent this on account of the others coming from central part.

These specimens have since been identified as *Araucarioxylon protoaraucana* Brea 1997. The locality today is known to be Middle Triassic in age (Spalletti *et al.*

Figure 5. Darwin's Fossil Forest at Aqua de la Zorra. Photographs taken by María B. Aguirre Urreta (supplied E. G. Ottone) at the Gondwana Meeting field trip in November 2005.

1999) and referred to as 'Darwin's Petrified Forest' (Figure 5). Brea et al. (2008) have suggested that the trees were evergreen and that the forest grew under dry, subtropical, strongly seasonal conditions. The tree density was estimated to be 425–759 per hectare with an upper stratum of corystosperm gymnosperms (20–26 m), a second stratum of

conifers (16–20 m) and an understorey of ferns. Because it is one of the most famous fossil deposits in Argentina it is now preserved by State legislation as a Nature Reserve (Ottone, 2005).

Chile

Darwin returned to from Mendoza to northern Chile and in May 1835 and found a greenish stratified feldspathic rock:

> *which I believe is altered clay-slate, conformably capped by porphyries and porphyritic conglomerate of great thickness, dipping at an average angle of 20° to NE. by N. The uppermost beds consist of conglomerates and sandstone only a little metamorphosed, and conformably covered by a gypseous formation of very great thickness, but much denuded. The upper half of this gypseous formation is mainly formed of the same calcareous clay-shale rock, but without any gypsum, and varying extremely in nature: it passes from a soft, coarse, earthy, ferruginous state, including particles of quartz, into compact clay-stones with crystallised oxide of iron,—into porcellanic layers, alternating with seams of calcareous matter,—and into green porcelain-jasper excessively hard, but easily fusible. Strata of this nature alternate with much black and brown siliceo-calcareous slate, remarkable from the wonderful number of huge embedded logs of silicified wood. This wood, according to Mr. R. Brown, is (judging from several specimens) all coniferous.* (1876 p. 536)

This must be the same locality that Darwin wrote about while staying in the house of Don Benito Cruz in the Valley of Copiapo in northern Chile (1889, Chapter XV 1835: 11th June, 1835):

> *I stayed two days collecting fossil shells and wood. Great prostrate silicified trunks of trees, embedded in a conglomerate, were extraordinarily numerous. I measured one which was fifteen feet in circumference projecting from the side of a hill: how surprising it is that every atom of the woody matter in the great cylinder should have been removed and replaced by silex so perfectly, that each vessel and pore is preserved! These trees flourished at about the period of the lower chalk; they all belonged to the fir-tribe.*

Darwin (1876, p. 573):

> *brought home many specimens, and all of them, according to Mr. R. Brown, present a coniferous structure.*

and wrote in his notes of his specimen no. 92:

> *Embedded in conglomerate at considerable elevation Cordillera of Copiapo there is part of great tree not standing upright at Latitude 270 30'".*

Unfortunately, there is no number 92 in the Darwin collection although number 91 (Figure 6B) is probably from this locality.

Peru

The *Beagle* sailed northwards to Peru and on July 12th anchored in the port of Iquique (now in Chile). Darwin set off the next day for the saltpetre mines in a large inland plain at 3,300 feet above the Pacific. Darwin (1876, p. 305) recorded a specimen from here as "yellow wood dug out of great alluvial plain, 3,000 feet above sea, now quite barren and covered with stratum of nitrate of soda and some [Luminate] at Iquique Lat 200 S. Peru". This was Darwin's specimen No. 44 (Figure 6 A) which is now believed to be Quaternary in age.

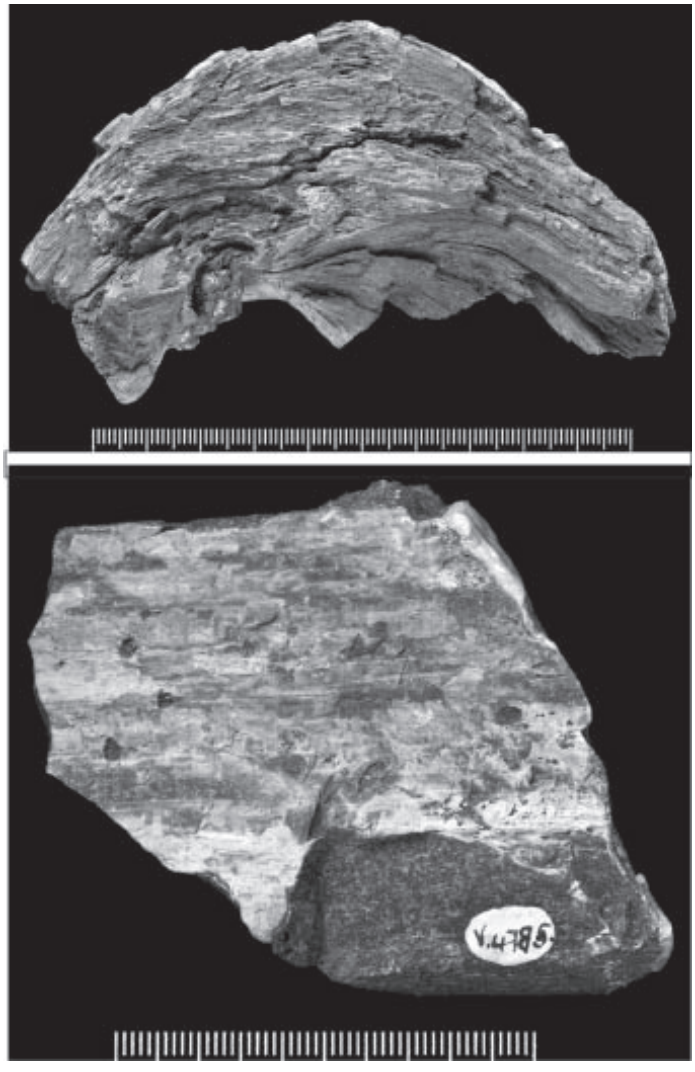

Figure 6. Top: Wood from Iquique, Chile, Quaternary, V. 4778.
Bottom: Wood from Copiapó, Chile

Australia

When the *Beagle* had reached Sydney Cove, Australia on 13th January, 1836, Darwin left the ship and travelled 120 miles inland to Bathurst. In his Journal he described his impressions of the land, settlers, convicts and aborigines but gave no mention of collecting any fossils. Darwin (1876, p. 147; 1864, p. 131) also wrote of his ride to Bathurst:

> *The sandstone of the Blue Mountains is at least 1,200 feet thick, and in some parts is apparently of greater thickness; it consists of small grains of quartz, cemented by white earthy matter, and it abounds with ferruginous veins. The lower beds sometimes alternate with shales and coal: at Wolgan I found in carbonaceous shale leaves of the Glossopteris Brownii, a fern which so frequently accompanies the coal of Australia.*

There are no known specimens of *Glossopteris* collected by Darwin in the

collections of the Natural History Museum, London. However, in his collection there are a couple of pieces of silicified wood from Illiwarra, New South Wales that are Permo-Carboniferous in age. Illiwarra is a coastal region to the south of Sydney and as Darwin makes no mention of travelling south it is a reasonable assumption to suppose he was given the fossil wood in Sydney. Darwin's numbers for these are 443 (Figure 7) and 444 and transverse, tangential longitudinal and radial longitudinal sections have been cut from 443 showing well preserved cellular detail of the wood. Such fossil wood appears to have been plentiful there as Arber (1905) quoted a Mr Hamilton from Sydney as saying that the wood is common in the Newcastle Series of New South Wales:

> *Large trunks have been found at Mount Kembba and elsewhere stumps and trunks, as well as smaller fragments are common.*

Interestingly when Arber was cataloguing the Gondwana plant fossils in the Natural History Museum and giving an account of fossil wood from Illawarra he made no mention of Darwin's specimens. Instead, Arber concentrated on specimens from here that had been cut and polished by Nicol (1833). Arber gave them the new specific

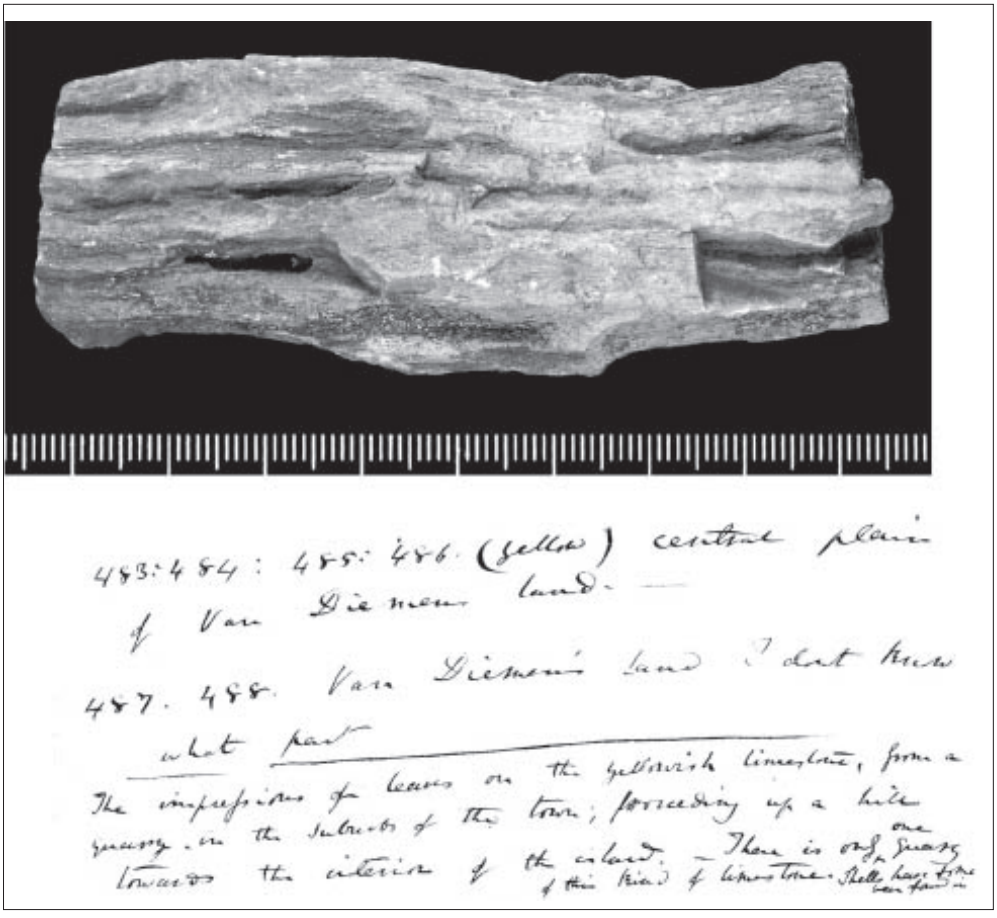

Figure 7. Dadoxylon arberi Hooker from Illiwari, New South Wales, Australia, V. 4492 together with Darwin's notes on his specimens collected at Illiwari. (probably Tertiary), V. 4788.

name of *Dadoxylon australe*, but this identification was challenged by Seward (1919) who gave them the new name *Dadoxylon arberi*. It is just possible that Arber had finished making notes of the specimens in the Museum and had gone away to write the Catalogue when Darwin's specimens were transferred from Botany to Geology in 1898. Darwin's specimens have subsequently been labelled as *Dadoxylon arberi*.

The *Beagle* then sailed to Van Dieman's Land [Tasmania] reaching Hobart Town on the 4th February, 1836. Darwin (1889) wrote:

> *The Beagle stayed here ten days, and in this time I made several pleasant little excursions, chiefly with the object of examining the geological structure of the immediate neighbourhood. The main points of interest consist, first, in some highly fossiliferous strata belonging to the Devonian or Carboniferous period; secondly, in proofs of a late small rise of the land; and lastly, in a solitary and superficial patch of yellowish limestone or travertine, which contains numerous impressions of leaves of trees, together with land-shells, not now existing.*

Darwin's collection has specimens from the Roos-Tunbridge area in the central plain of Van Dieman's Land, but it is most likely that these were given to him rather than collected by him. These came "most probably in the area now known as the Midlands, which is a large graben that more or less divides eastern Tasmania from western Tasmania. It is mainly Palaeogene infill and has many fossils scattered here. They haven't attracted much attention because they mostly seem reworked leaving little hope for dating or environmental context" (pers. comm. Dr Greg Jordan, University of Tasmania). Banks (1971) compiled a list of numbers from those given in a catalogue of Darwin's specimens from Tasmania from his 22 page manuscript notes in the collections of papers in the library of Cambridge University. Banks quite rightly assumed that the numbers in the margin of the manuscript referred to specimen numbers collected at the sites mentioned or the rocks mentioned in the immediate sub adjacent text. The numbers 3483 and 3488 were given in his manuscript notes for "silicified wood from the level district at the source of the Derwent and Tamar" [Campbell Town – Tunbridge Region]. The first number 3 has been omitted from Darwin's numbers on his specimens. Perhaps it was his notation of the locality or collection number. Darwin numbered his pieces of wood as 483–488 and number 487 is preserved well enough to have been subsequently identified as *Cupressoxylon hookeri* Arber (Figure 8). The others are unfortunately very badly preserved and show signs of being water-worn before preservation, therefore being unidentifiable. Darwin's specimens were omitted once again from Arber's *Catalogue of the Glossopteris flora* (1905) where he concentrated on specimens prepared by Nicol (1831). Darwin could not have seen either of Nicol's papers while he was away on board the *Beagle*, but it is reasonable to assume that Brown would have done so.

In a local Hobart quarry Darwin found fossilised leaves in what are now known to be Tertiary deposits. He wrote (Darwin, 1889) "The impressions of leaves on the yellowish limestone, from a quarry in the suburbs of the town [Hobart]; proceeding up a hill towards the interior of the island, There is only one quarry of this kind of Limestone" (Figure 8 notes). Darwin (1876) gave much more detail of this quarry as:

> *Behind Hobart Town there is a small quarry of a hard travertin, the lower strata of which abound with distinct impressions of leaves. Mr. Robert Brown had the kindness*

to look at my specimens, and he informed me that there are four or five kinds, none of which he recognises as belonging to existing species. The most remarkable leaf is palmate, like that of a fan-palm, and no plant having leaves of this structure has hitherto been discovered in Van Diemen's Land. The other leaves do not resemble the most usual form of the Eucalyptus, (of which tribe the existing forests are chiefly composed,) nor do they resemble that class of exceptions to the common form of the leaves of the Eucalyptus, which occur in this island. The travertin containing this remnant of a lost vegetation, is of a pale yellow colour, hard, and in parts even crystalline; but not compact, and is everywhere penetrated by minute, tortuous, cylindrical pores. It contains a very few pebbles of quartz, and occasionally layers of chalcedonic nodules, like those of chert in our Greensand. From the pureness of this calcareous rock, it has been searched for in other places, but has never been found. From this circumstance, and from the character of the deposit, it was probably formed by a calcareous spring entering a small pool or narrow creek. The strata have subsequently been tilted and fissured; and the surface has been covered by a singular mass, with which, also, a large fissure has been filled up, formed of balls of trap embedded in a mixture of wacke and a white, earthy, alumino-calcareous substance. Hence it would appear, as if a volcanic eruption had taken place on the borders of the pool, in which the calcareous matter was depositing, and had broken it up and drained it.

Figure 8. Wood from the central plain, Tasmania, Australia. V. 5317 together with Darwin's notes on his specimens and on the presence of leaf fossils in a quarry in Hobart.

Banks (1971) discussed the possible sites of this quarry and concluded it was one in upper Burnett Street that supplied lime to Shoebridge's Lime Kiln. The quarry is no longer accessible having been converted into a skateboard park. Banks (1971) quoted the numbers 3489–3494 from Darwin's notes for:

impressions of leaves (fossil dichotyledons), quarry of limestone within Hobart Town.

Banks (1971) suggests that Darwin's manuscript on Tasmania was written at sea, i.e. before he returned to England on 2nd October, 1836, and was able to refer to the more recently published works on fossils. Darwin's specimens have not been found in the collections of the Natural History Museum, London, although there is a note on Darwin's specimen list:

The impressions of leaves in the yellowish limestone, from a quarry, in the suburbs of the town, proceeding up a hill towards the interior of the island. There is only one quarry of this kind of limestone. Shells have been found in this quarry.

The *Beagle* sailed from Tasmania on the 7th February and reached King George's Sound, close to the South West Corner of Australia on the 6th March. At Bald Head Darwin went to see the structures that had been described by many others as corals or petrified trees standing where they had been growing. Darwin (1876) wrote:

> *The branches are absolutely undistinguishable in shape from the broken and upright stumps of a thicket; their roots are often uncovered, and are seen to diverge on all sides; here and there a branch lies prostrate. The branches generally consist of the sandstone, rather firmer than the surrounding matter, with the central parts filled, either with friable calcareous matter, or with a substalagmitic variety; this central part is also frequently penetrated by linear crevices, sometimes, though rarely, containing a trace of woody matter. These calcareous, branching bodies, appear to have been formed by fine calcareous matter being washed into the casts or cavities, left by the decay of branches and roots of thickets, buried under drifted sand. The whole surface of the hill is now undergoing disintegration, and hence the casts, which are compact and hard, are left projecting. In calcareous sand at the Cape of Good Hope, I found the casts, described by Abel, quite similar to these at Bald Head; but their centres are often filled with black carbonaceous matter, not yet removed. It is not surprising, that the woody matter should have been almost entirely removed from the casts on Bald Head; for it is certain, that many centuries must have elapsed since the thickets were buried; at present, owing to the form and height of the narrow promontory, no sand is drifted up, and the whole surface, as I have remarked, is wearing away. We must, therefore, look back to a period when the land stood lower, of which the French naturalists found evidence in upraised shells of recent species, for the drifting on Bald Head of the calcareous and quartzose sand, and the consequent embedment of the vegetable remains. There was only one appearance which at first made me doubt concerning the origin of the cast,—namely, that the finer roots from different stems sometimes became united together into upright plates or veins; but when the manner is borne in mind in which fine roots often fill up cracks in hard earth, and that these roots would decay and leave hollows, as well as the stems, there is no real difficulty in this case. Besides the calcareous branches from the Cape of Good Hope, I have seen casts, of exactly the same forms, from Madeira and Dr. J. Macaulay has fully described (Edinb. New Phil. Journ. vol. xxix. p. 350) the casts from Madeira. He considers (differently from Mr. Smith of Jordan Hill) these bodies to be corals, and the calcareous deposit to be of subaqueous origin. His arguments chiefly rest (for his remarks on their structure are vague) on the great quantity of the calcareous matter, and on the casts containing animal matter, as shown by their evolving ammonia. Had Dr. Macaulay seen the enormous masses of rolled particles of shells and corals on the beach of Ascension, and especially on coral-reefs; and had he reflected on the effects of long-continued, gentle winds, in drifting up the finer particles, he would hardly have advanced the argument of quantity, which is seldom trustworthy in geology. If the calcareous matter has originated from disintegrated shells and corals, the presence of animal matter is what might have been expected. Mr. Anderson analyzed for Dr. Macaulay part of a cast, and he found it composed of -*
>
> | | |
> |---|---|
> | *Carbonate of lime* | *73.15* |
> | *Silica* | *11.90* |
> | *Phosphate of lime* | *8.81* |
> | *Animal matter* | *4.25* |
> | *Sulphate of lime* | *a trace* |

> *from Bermuda; at this latter place, the surrounding calcareous rocks, judging from the specimens collected by Lieut. Nelson, are likewise similar, as is their subaërial formation. Reflecting on the stratification of the deposit on Bald Head,—on the irregularly alternating layers of substalagmitic rock,—on the uniformly sized, and rounded particles, apparently of sea-shells and corals,—on the abundance of land-shells throughout the mass,—and finally, on the absolute resemblance of the calcareous casts, to the stumps, roots, and branches of that kind of vegetation, which would grow on sand-hillocks, I think there can be no reasonable doubt, notwithstanding the different opinion of some authors, that a true view of their origin has been here given.*

Darwin (1889) summarised this as:

> *According to our view, the beds have been formed by the wind having heaped up fine sand, composed of minute rounded particles of shells and corals, during which process branches and roots of trees, together with many land-shells, became enclosed. The whole then became consolidated by the percolation of calcareous matter and the cylindrical cavities left by the decaying wood were also filled up with a hard pseudo-stalactitical stone. The weather is now wearing away the softer parts, and in consequence the hard casts of the roots and branches of the trees projects above the surface, and, in a singularly deceptive manner, resemble the stumps of a dead thicket.*

It is not known if Darwin collected specimens from this site, but there are none in the Natural History Museum Collections.

Darwin's continued interest in fossil trees

Darwin continued with his interest on fossil plants after he returned to Britain and set about the task of writing up the accounts of his voyage, in his later books and letters. Indeed, while Darwin was writing his *On the Origin of Species by Means of Natural Selection* (1859) he must have been aware of Lyell's descriptions of fossil trees in Nova Scotia (Lyell 1843, 1845: Lyell and Dawson, 1853). More information on these trees was later published by Dawson (1882), Ferguson (1988) and Thomas (2005) and the locality has been placed on Canada's list of potential UNESCO World Heritage Sites (Falcon-Lang and Calder 2004). Therefore, when Darwin wrote Section VI: Geology in Herschel (1851) he referred to the need for:

> *Careful examination in any new coal district; the chief points being, the presence of upright vegetables and trunks of trees (of the position of which careful drawings should be made), and whether furnished with roots, the nature of the coal beds on which the coal rests, and generally of the strata, the continuousness and form of the strata, and whether ripple-marked, the existence of animal remains, and whether such lived on the spot or were drifted.*

Later, Darwin (1868) referred to a fossil vine but gave no real details about any specimens.

The Darwin collection of plant fossils

As explained above, Darwin sent his fossil wood specimens to Robert Brown for identification. Darwin was clearly pleased with this arrangement because, after he returned to Britain, he wrote to Henslow in May 1837:

> *Mr. Brown has been taking a good deal of interest in my affairs & in a most kind manner. I want therefore to oblige him any way I can.—He was much pleased with the fossil woods & has gone to the expense of having several of them cut & ground.—The*

clump of trees which were growing vertically are allied to Araucaria, but in some respects resembling yews.—Some of the good wise people, till seeing the wood, thought I had mistaken calcareous concretions for trees!

Occasionally in his notes on the fossils he was collecting, the words yellow or green appear. His list of plant fossils in the Natural history Museum suggests that it refers to the colour of the paper that the specimens were wrapped in. Darwin's plant fossils were retained in the botany collections of the British Museum and moved to the new Natural History Museum in South Kensington. The specimens and Darwin's notes on them were later transferred to the Department of Palaeontology in 1898 where they were subsequently registered in the collections. The four specimens of *Nothofagu*s collected by Darwin in Tierra del Fuego somehow found there way in the collections of the Mineralogy Department and were only transferred to Palaeontology in 1931.

Acknowledgements

I thank the Natural History Museum London for allowing permission to publish the photographs and the Darwin notes and Dr Peta Hayes for her help. The table of Darwin specimens was modified from a spread sheet initially prepared for the Natural History Museum by Jenny Cripps.

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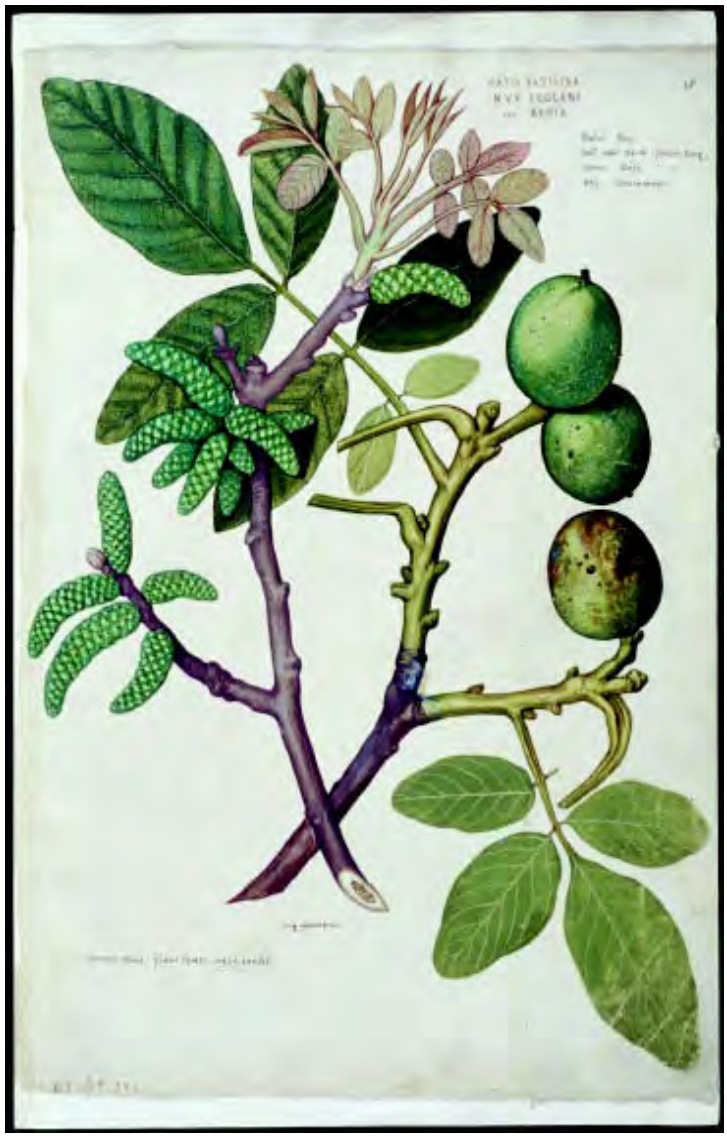
Book Review

Drawn after Nature – the complete watercolours of the 16th-century *Libri Picturati*. Jan de Koning, Gerda van Uffelen, Alicja Zemanek & Bogdan Zemanek (eds), 378 pp., multiple colour plates, 2008. KNNV Publishing, Zeist, The Netherlands, ISBN 978 90 5011 2383, NUR 941. Hardbound, price EUR 69.95.

Drawn after Nature portrays a unique and fascinating collection of 1,429 watercolours of plants (with a few of fungi and animals) dating from the second half of the 16th century. The core of the collection was assembled by the Flemish nobleman Charles de St. Omer, who was a good friend and patron of the great renaissance botanist Carolus Clusius. Strong evidence is presented that Clusius played a significant role in the scope and annotation of this collection, and that many of the watercolours were later used by the Plantin press to make woodblocks for some of Clusius' later books. Based on archival sources and an analysis of watermarks in the various papers used, the core collection must date from the decade following the year 1564. Later additions were made by the Count of Arenberg, another Flemish plant enthusiast from Clusius' extensive network. In the 17th century the collection turns up in the library of Elector Friedrich Wilhem of Brandenburg which was to become the Prussian State Library in Berlin whence, in the second world war, the collections were moved for safekeeping. They ended up in the Jagiellon Library in Kraków after the war, where they are lovingly curated as *Libri Picturati*, volumes A18–A30.

Dragon arum (*Dracunculus vulgaris* – labelled *Dracvuncvli minoris - flos*)

The Dutch and Polish Editors, together with an international team of 11 scholars, have now provided full access to these wonderful watercolours, which in scope and quality are on a par with such glorified examples of 16th century botanical illustration as the *Codex Fuchs*, kept in Vienna. All plates are reproduced (albeit in rather small thumbnails of 4 x 6 cm) and their handwritten annotations fully transcribed. A fine selection of 62 of the plates are also reproduced almost full-size (23 x 33.5 cm), and another *ca*. 200 plates are given at intermediate reduction (mostly 7.5 x 10.5 cm).



Walnut (*Juglans regia* – labelled *NVX IVGLANS- seú Regia – Seritur vbinis: planis tamen magis gaudet*)

The very readable introductory chapters concern various historical aspects (with contributions by Florike van Egmond, Piotr Hordýnski, Luis Ramon-Laca, Andrea Ubrizsy Savoia, Gerda van Uffelen and Renate Schipke). Biological, morphological, phytogeograpical and ecological information highlighted in the watercolours and annotations is analysed in chapters by Alicja and Bogdan Zemanek and Andrea Ubrizsy Savoia. Italian, French, German and Dutch common plant names found in the annotations are analysed by Savoia and Van Uffelen. Another series of chapters deals with special biological categories or commodity groups illustrated: cryptogams by Thomasz Majewski, animals by the late Lipke B. Holthuis, food plants, fodder plants and ornamental plants by Van Uffelen, and medicinal plants, kitchen herbs and technical plants by Jan de Koning.

Assorted wild roses: Top left: *Rosa foetida*; top right: *R. pimpinellifolia*; bottom left: *R. rubiginosa*; bottom right: *R. canina* and its fruit.

These chapters show to what extent the *Libri Picturati* project is still *work in progress*. Thanks especially to the careful study of archival sources by Helena Wille from Leuven and several authors contributing to this book we can now be confident about the historical origins of these *Libri Picturati*. Consequently the recent hypothesis by the American art historian Claudia Swan (1998) that they represent a collection of the first curator of the Leiden Botanical Garden, Theodorus Clutius, can be relegated to the realm of fables.

However, much remains to be learned on the various roles this collection fulfilled in teaching, research and culture or just visual delight in 16th century Europe. This makes the book all the more attractive, because it invites the reader as it were to explore the annotated drawings and historical facts for themselves and speculate on the gaps in our understanding.

The very beautiful lay-out of the book has in my opinion one weakness: the strong reduction in size of the bulk of the plates just removes too much of the rich detail that makes these plates so attractive. If all plates had been reproduced at the intermediate size of 7.5 x 10.5 cm, allowing the omission of 150 duplicated reproductions, and a fuller use of the page size (there is a lot of white left on most of them), more justice would have been done to their beauty and information content. Perhaps the publishers and curators of the Libri Picturati could remedy this by either providing a CD-Rom with high resolution images to accompany a second print run, or by posting all watercolours on a website.

Meanwhile we owe the editors and authors of *"Drawn after Nature"* thanks for providing us with a wonderful book on an early landmark in the rich history of botanical illustration.

PIETER BAAS FLS,
Leiden

Obituary

Ian Gauld FLS (1947–2009)
Master taxonomist and morphologist

On 12th January, 2009 the Linnean Society and biology more generally lost one of its most accomplished and prolific taxonomists, Ian D. Gauld, recently retired from the Natural History Museum (NHM), London where he held positions in the Department of Entomology as Senior Scientific Officer (appointed 1982), Principal Scientific Officer (appointed 1985), and Deputy Keeper of Entomology (appointed 1990). He had been a Fellow of the Linnean Society since 1991. In 1993 he was seconded to the Biodiversity Office as Biodiversity Representative for the NHM and travelled widely as its "biodiversity ambassador." In 1999 he was awarded an Individual Merit Promotion (the academic equivalent of a personal university chair). Prior to his appointments at the NHM he was a Senior Scientific Officer at the Commonwealth Institute of Biology, where he worked from 1974 to 1981. He was awarded a PhD degree by the Council for National Academic Awards in 1983. At the time of his death he was President of the American Entomological Institute (Gainesville, Florida, USA) and an active Scientific Associate of the NHM. He described, singly or jointly with collaborators, 1,481 new species, and was author, co-author or editor of 99 scientific papers (some of them monograph length) and nine books.

Ian Gauld enthusiastically helping para-taxonomists as part of a Darwin Initiative project in the Mbaracayú Forest Nature reserve in eastern Paraguay (1995).

Ian Gauld was widely recognised as the world's foremost living expert on the classification and general biology of the wasp family Ichneumonidae, a family of parasitic insects that contains more species than all vertebrates combined. Gauld's research on this group was crucial for studies in both applied and basic entomological research. In a lifetime dedicated to comprehending the taxonomy of these insects, Gauld not only discovered a large number of new species, but he was known for both his prodigious productivity, and for the high quality of his work, thanks to a precise eye, a remarkable memory for morphological details, an innate talent for drawing them, and a consuming passion for his organisms. He was also a fine teacher of future systematists, especially appreciated in Costa Rica where he did extensive

fieldwork, trained local entomologists, served on committees of graduate students at the University of Costa Rica, and supported the work of the Costa Rican National Biodiversity Institute (INBio) from the time of its foundation in 1989. Rodrigo Gamez, founder and director of INBio, called Gauld "a great friend and collaborator" who helped to establish biodiversity studies in Costa Rica.

Gauld completed an impressive series of large and difficult taxonomic projects, each of them grander in scope than most of his colleagues would contemplate starting. The last 25 years of his life were largely taken up with his long-term project of descibing and reclassifying the Inchneumonidae of Costa Rica. He had an unsurpassed knowledge of the family, gained through years of experience examining millions of specimens from around the world. Gauld was a master morphologist who was able to compare and analyse large numbers of genera and higher taxonomic levels. Systematists with these skills are an increasing rarity in a world increasingly in need of them, as biodiversity surveys increase in importance and biologists attempt to reconstruct the tree of life.

Gauld, with Barry Bolton (also of the NHM) edited and largely wrote *The Hymenoptera* (1988), the first modern, book-length synthesis on the classification and biology of the wasps, ants and bees of the world. It quickly became the standard reference on the group. He collaborated with Paul Hanson to edit and write *The Hymenoptera of Costa Rica* (1995), an 893-page survey of the wasp fauna of that country. This was followed by *Hymenoptera de la Región Neotropical* (2006), a 994-page volume in Spanish on Neotropical Hymenoptera. Both books extensively reviewed biological information on this hyper-diverse order of insects, making it accessible to Latin American students and scholars. Joint research and publications with ecologists Kevin Gaston and Daniel Janzen reflected Gauld's belief that all taxonomists should reach beyond the confines of museum-based work to contribute high-quality data to studies in related fields.

Ian Gauld was one of those rare exuberant and unassuming human beings who had an uncanny ability to connect with everyone he met, from politicians to *campesinos*, children and adults. Wherever he travelled – and he worked extensively throughout the tropics – neither language, age, nor rank was ever a barrier to friendship and collaboration. He loved good company, good wine and a good meal. Although unpretentious he was capable of great eloquence when speaking of the challenges of scientific work and of dealing with those who do it. Students and colleagues who visited the United Kingdom were always welcome to stay in his house, where he and his wife, the late Pam Mitchell, were gracious and amusing hosts. Gauld's untimely death brings a premature end to a lifetime of passionate work in entomology, and deprives his colleagues of a master taxonomist, a larger-than-life character whose knowledge and temperament made him an irreplaceable resource and friend.

PAUL HANSON, DANIEL JANZEN,
SANDRA KNAPP FLS, MALCOLM SCOBLE FLS,
DAVID WAHL, MARY JANE WEST-EBERHARD

The Linnean Society
Programme

16th Apr	Thurs. 6:00pm	SECOND ANNUAL BIODIVERSITY POLICY LECTURE John Beddington	Evening Meeting**
14th May	Thurs.	THE FUTURE OF PLANT GENETIC RESOURCES †Sandra Knapp FLS	Day Meeting in Honour of Jack Hawkes**
21st May*	Thurs.	ANNIVERSARY MEETING David Cutler PLS	Afternoon Meeting
18th June	Thurs 6:00pm	FORENSIC ECOLOGY – ITS CONTRIBUTION TO CRIMINAL INVESTIGATION Patricia Wiltshire FLS	Evening Meeting
25-26th June	Thurs. – Fri.	BIODIVERSITY, INFECTION AND GLOBAL HEALTH: FUTURE TRENDS AND POLICY RELEVANCE †Vaughan Southgate FLS and David Molyneux Joint two day meeting with the RSTMH **	
3rd July	Fri. 3.30pm	Celebrating the life of John Marsden HonFLS	Afternoon and Evening Meeting **
9th July	Thurs.	CONVERSAZIONE **	
17th Sept.	Thurs. 6:00pm	THE "IRRITABLE POWER" OF CARNIVOROUS PLANTS: MARY TREAT, CHARLES DARWIN, AND THE LANGUAGE OF FLOWERS †Dawn Sanders FLS and Tina Gianquitto	Evening Meeting
1st-2nd Oct	Thurs. Fri.	EVOLUTION, ECOLOGY AND EXTINCTION ON THE SMALLER INDIAN OCEAN ISLANDS † Robert Prys Jones and Julian Hume	2-Day Meeting **
15th Oct*	Thurs 6.00pm	A GENERAL NATURALIST IN MODERN TIMES Martin Jacoby FLS	Evening Meeting
17th Nov	Tues	THE GALAPAGOS ARCHIPELAGO: A LIVING LABORATORY † Sandra Knapp FLS and Sarah Darwin FLS	Day Meeting **
19th Nov	Thurs	LINNEAN SOCIETY DEBATE † Mary Gibby FLS	Afternoon and Evening Meeting **

* Election of new Fellows † organiser ** Registration required

Unless stated otherwise, all meetings are held in the Society's Rooms. Evening meetings start at 6.00pm with tea available in the library from 5.30. For further details please contact the Society office or consult the website (address inside the front cover).

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