Alfred Russel Wallace
1823-1913

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The name Alfred Russel Wallace is usually first linked to Charles Darwin (1809-1882) and the development of the theory of natural selection. In recent years, in fact, the Darwin-Wallace relationship has become among the most studied subjects in the history of science. It has only rarely been appreciated, however, that Wallace also made many valuable contributions to a variety of other fields of study. Few thinkers of his time could match him in the sheer breadth of his attention, which touched on items as diverse as the poetry of Edgar Allan Poe, socialism, spiritualism, extraterrestrial life, zoogeography, ethnography, women's rights, physical geography, animal behaviour, and language, to name only some. Though overshadowed by Darwin, Wallace nonetheless rates as the greatest tropical naturalist of the nineteenth century and as an original thinker of the highest rank.

Despite Wallace's many contributions, his place in the history of science was largely ignored for some fifty years after his death in 1913. This came about in part from his association with several unpopular causes during his long lifetime, and to his habit of responding with both barrels to any poorly constructed argument he came across. But much of the relative obscurity into which his name fell can also be attributed to his general unwillingness to seek priority for his many ideas. He never considered himself to be a practising scientist or in competition with the same; indeed, his published works are almost entirely empirical and/or philosophical in nature (perhaps largely because he never had available to him the resources required to undertake experimental investigations). But during the last twenty years there has been a great revival of interest in Wallace's ideas, both for their general quality and for the extent to which he was ahead of his time on many issues (especially social ones). Moreover, there is much of the humanist evident in Wallace's writings, which contrast pleasantly with some of his contemporaries' coarse extensions of the notion of the 'survival of the fittest' (a term which Wallace himself was largely responsible for introducing into the biological literature) to social theory. Still, his contributions to, and influence on, geographical studies have been almost totally neglected. This is unfortunate, for he was a pioneer in the areas of glacial theory, land use planning, geographical education, oceanography, diffusion studies, and above all, zoogeography and island biogeography.

1. *EDUCATION, LIFE AND WORK*

Alfred Russel Wallace was born on 8 January 1823 at Usk in Monmouthshire into a middle class family of modest means. Alfred was obliged to leave school at the age of thirteen to be apprenticed to a builder in London. Though his stay in London lasted only about six months, this period constituted an important stage in his general education, as during it he and his older brother John attended a number of public lectures on various subjects of an intellectual nature. One of these was given in 1837 by the great social reformer Robert Owen, who made such an impression on the teenager as to make him a devotee for the rest of his life. At the age of fourteen Alfred decided to leave London

and join another brother, William, to learn the surveying trade. The outdoor work was to his liking, and he spent much of the next several years in the field in Wales and southwestern England. This period was followed by a short but important stint as a secondary school teacher at the Collegiate School, Leicester, from 1844-6. Not only did this position afford him access to a good library containing most of the more important scientific literature of the day, but in 1844 he also had the good fortune of meeting Henry Walter Bates. Bates, not yet in his twenties, was an avid beetle collector who had already published scientific work. The two became friends immediately and Bates' passion for natural history collecting soon ignited Wallace's interest. Before anything could come of the association, however, Wallace was obliged to leave his job when his brother William suddenly died in 1846 and he and John were left with the responsibility of settling his affairs.

The next two years mark a period of transition for Wallace. Though he was able to support himself by taking surveying and building jobs, his interest in natural history continued to grow. It was during this time that he had the idea of becoming a full-time, self-employed collector. Reasoning that they should be able to make enough money from the sale of duplicate specimens to support themselves in the field indefinitely, he proposed to Bates in 1847 a joint collecting expedition to South America. Wallace had a second purpose in mind in making this proposal: inspired by his recent reading of the works of Robert Chambers (whose *Vestiges of the Natural History of Creation* was published in 1844), Thomas Malthus, Alexander Humboldt, Charles Lyell, as well as the early writings of Charles Darwin and already supporting the doctrine of organic change, he believed that he could gain a clue as to the mechanism of evolution by familiarizing himself at first hand with the details of the distribution of organisms. Bates approved of the venture and in 1848 the expedition began. Wallace was to stay in South America for four years. During the first part of this period the two naturalists collected as a team but eventually they broke up, with Wallace concentrating on the Rio Negro area. In addition to establishing a scientific reputation as a collector and observer during these years, Wallace put considerable effort into mapping the areas he explored and learning the ways of the native peoples. His maps proved to be quite accurate and became the standard reference on the area for many years; his experiences with 'man in the natural state' had a profound influence on the development of his ideas on the place of civilized man and the structure of his social system. A further event of interest during the expedition was the appearance of his first publication, 'On the umbrella bird'.

In 1852, in poor health and distraught after the death in 1851 at Belem of his younger brother Herbert (who had joined the expedition the year before), Wallace left Bates in South America and returned to England. During the voyage home the ship unfortunately caught fire and sank. Wallace and the entire crew were rescued at sea, but virtually his entire collection was lost. Only a small tin containing some drawings and other odds and ends was saved.

The next eighteen months of Wallace's life were spent vacationing, regaining his health, and writing his first two books, one a treatment of Amazonian palm trees and the other a naturalist's travel log of his experiences and observations in South America. Meanwhile, he was already looking ahead to the possibility of another collecting expedition. The two possible locations were Africa and the Malay Archipelago; finally the latter was chosen, in part because Wallace was curious to find out whether island conditions perpetrated the kind of barrier conditions on organismal dispersal that he had observed in the Amazon. Securing a grant from the Royal Geographical Society in 1854 to defray travel expenses for himself and a young assistant, he again left England.

The Malay expedition was by far the most important educational experience of Wallace's life. He travelled to all the major islands of the region and to many of the lesser ones as well and several places were visited on a number of occasions. His thoroughness rewarded him with a collection of 126,000 specimens, rivalling or surpassing those in any of the world's museums. This occupied him for many years after his return to England. More significantly, the eight year expedition provided him with the opportunity to consider in depth the characteristics of organismal distribution and how these were related to the evolution of species. Here too was the perfect setting to study the meaning of organic adaptation. It was during this time that Wallace seized on the importance of Malthus' ideas to the notion of organic change and came up with the idea of natural selection. As the now well-known story goes, Wallace hit on the idea while delirious during a bout of malaria. As soon as he recovered he wrote it out and sent it to Darwin (whose famous book *The Origin of Species* appeared in 1859), for 'comment' and possible forwarding to Lyell, at that time the best known naturalist in England. Darwin was stunned and sought advice from his two closest friends, Lyell and Joseph Hooker, on how to deal with this challenge to his priority, for at that time he had not published any of his ideas on organic change. Their solution to the dilemma was to suggest that both the Wallace paper and an abstract of Darwin's work should be read at the next meeting of the Linnean Society of London, and this took place on 1 July 1858.

Wallace's activities in the Malay region were not restricted to contemplation of the evolutionary process. His travels in much of the area amounted to exploration; on several islands (including New Guinea) he actually became the first European to take up residence. Years of contact later made him an oft-consulted authority on the peoples of the area, with whose trade patterns, languages, and origins he particularly concerned himself. He also took great interest in the geology and physical geography of the area, especially as these can be related to the explanation of differences in organic diversity among the islands. While still in the field, he wrote and published a number of papers on proposed taxonomic revision and accounts of his travels in then largely unknown places. He also developed a strong interest in animal behaviour, and contributed several early works on the habits of the orangutan.

In 1862 Wallace again returned to England. He was by then a considerable celebrity within scientific

circles, and soon made the acquaintance of a large proportion of the important members of the London intellectual community. This was still buzzing over the recent publication of Darwin's *Origin*, and Wallace plunged into the discussion as a strong supporter of the general Darwinian position. Wallace's versions of evolution and natural selection were not carbon copies of Darwin's, however, and the two opinions soon diverged on several issues, notably the relation of natural selection to human cultural evolution, the role of sexual selection in evolution, and the interpretation of several biogeographical matters. Wallace published extensively on a number of subjects during the 1860s, but concentrated on taxonomic revisions, mimicry, the geographical distribution of animals, ethnography, and evolutionary theory, making important contributions to each field. During the early 1870s he began to focus his attention on the geographical distribution of species. This work culminated in his two most influential treatments of the subject, *The Geographical Distribution of Animals* (1876) and *Island Life* (1880).

About the same time his interest in social issues began to solidify into a point of view that became increasingly socialistic in nature. Over the next forty years he wrote frequently on subjects of social interest ranging from vaccination and women's rights to land nationalization and the balance of trade. Wallace's humanistic leanings became ever more apparent as he argued forcefully for anything he felt would improve the lot of the common man. He opposed the eugenics movement on the grounds that it would tend to perpetuate class distinctions. He suggested the idea of 'time-and-a-half' pay as compensation for excessive work schedules. But such ideas, coupled with his support of spiritualism and phrenology as legitimate subjects of study, only tended to alienate the more conservative thinkers of the time, who regarded him as a crank.

In 1866 Wallace married Annie Mitten, the young daughter of a friend and botanist William Mitten. Their family life was apparently a happy one, and Annie was both willing and able to assist Wallace in his studies. Tired of London social life, they moved in 1870 into the first of a series of country houses in which they spent most of their remaining life together (a period of over forty years). The one large personal problem that afflicted Wallace over this span was finance. He had no great facility for the management of money, and after his return to England never held a permanent full-time post of any kind. He was able, however, to earn a decently comfortable living from the income afforded by part-time employment as an Assistant Examiner in physical geography (from 1870), sales from his collection of specimens, royalties from his books, and eventually a government pension of £200 a year on Darwin's nomination. In 1886 he accepted an invitation from the Lowell Institute to give a series of public lectures in America, and spent a largely pleasant year touring the continent giving talks in Boston, New York, Washington D.C., Cincinnati, San Francisco, Denver, Toronto, Quebec and other places, as well as meeting and visiting eminent men of American science and letters. His productive life continued through his seventies and eighties, and his final two books were published in 1913, the year of his death at the age of ninety, on 7 November at Old Orchard, Broadstone, Dorset.

In reading accounts of Wallace's life (for example, Marchant, Osborn, George, and Brackman), one is struck by the general esteem in which virtually everyone who knew him held him. Apart from the clarity of his thinking, which few disputed, there was a general demeanour to his character that inspired respect. Intolerant of pomposity, arrogance, and snobbery, he was willing to spend considerable amounts of time responding in writing to the many non-professionals who regularly sought his advice on a great variety of matters. He was also on friendly terms with a large number of the intellectual dignitaries of his era despite the fact that he was not afraid to criticize their ideas when he thought such was justified. Probably few individuals in the public spotlight have led a more exemplary life from the point of view of personal ethical standards of behaviour.

In recognition of his contributions, Wallace received numerous honours over his long career. He accepted honorary doctorates from Dublin in 1882 and Oxford in 1889 before making it known that two were enough and that he would refuse the offer of any others. However, he accepted the Royal Medal of the Royal Society in 1868, the Gold Medal of the Société de Géographie in 1870, the Darwin Medal of the Royal Society in 1890, the Founders' Medal of the Royal Geographical Society and the Gold Medal of the Linnean Society of London in 1892, and the Copley Medal of the Royal Society, the Darwin-Wallace Medal of the Linnean Society of London, and the Order of Merit in 1908. The last two are particularly interesting; in the case of the Darwin-Wallace Medal, he became the first recipient of an award struck in his own honour! The awarding of the Order of Merit especially surprised him, however, as he was, in his own words, 'a red-hot Radical, Land Nationliser, Socialist, Anti-Militarist, etc.' (Marchant (1916), 447).

2. *SCIENTIFIC IDEAS AND GEOGRAPHICAL THOUGHT*

a. Evolutionary Studies

The concept of natural selection finally came to Wallace, as it did to Darwin, after reconsidering the work of Thomas Malthus on the limits to population growth. Initially, the Wallace version of natural selection was quite similar to that sponsored by Darwin; indeed, Darwin's reaction to the 1858 paper sent to him from the East was that he could not have prepared a better abstract of his own work himself. In 1864 Wallace published a paper on the evolution of man as deduced from the theory of natural selection, one of the works that most prepared the scientific community for Darwin's definitive treatment of the subject in 1871, *The Descent of Man*. In 1865 Wallace produced a masterly analysis of the butterfly populations of the Malay region in which the effects of natural selection, time, and geographical isolation were discussed with respect to the state of adaptational variation observable in that area today. In 1866 he expressed further important views on adaptational variation, again using natural selection as the vehicle for understanding the phenomenon.

Darwin was immensely pleased by these applications (and the many others Wallace produced) of their theory. But as the late 1860s approached, Wallace's thoughts on several issues began to diverge from Darwin's. The latter's first real inkling of this came in 1868 with Wallace's published expression of his new belief that natural selection could not be used to understand human evolution beyond the purely biological level. Darwin was horrified, fearing that Wallace had 'murdered' their own 'child'. Another dispute erupted over the relative importance of sexual selection in the evolutionary process; Darwin believed it to be of great importance, but Wallace was inclined to attribute sexual dimorphism to environmental influences on selection. They could also not agree on the interpretation of several biogeographical problems (dealt with in more detail below).

The penetrative power of Wallace's intellect is perhaps nowhere better illustrated than in his studies of the relationship of mimicry and protective colouration to the evolutionary process. Invariably overshadowed by the names of Bates and Muller when the history of this subject comes up (Bates and Muller have been immortalized by the terms 'Batesian' and 'Mullerian' mimicry), Wallace should nonetheless be viewed as an equally important contributor to the early theory of this subject. His contributions consisted of the logical extension, popularization, generalization, and application of Bates' and Muller's ideas and the elucidation of several types of protective colouration devices. He was thus able to demonstrate, perhaps better than anyone else at that time, specifically how the evolution of adaptations was functional within an environmental setting. Although not now generally remembered it was Wallace who, in conjunction with his studies of sympatric phenotypic variations, first introduced the concept of 'polymorphism' to science. He also generalized Bates' theory of mimicry into a set of laws referable to groups other than insects, popularized Muller's ideas, and introduced the concepts of warning colours, concealment colours (identifying but not quite accepting the principle of disruptive colouring), recognition colours, deflection colours, and alluring colours. These ideas were set out in a number of papers in the 1860s and 1870s and summarized in chapters five and six of *Tropical Nature* in 1878.

b. Descriptive Biology

Although Wallace was not a trained systematist, his association with Bates and long years of working with an enormous variety of specimens -- especially of birds, butterflies, and beetles -- gave him a thorough working knowledge of taxonomic principles. He was also a fair artist, a talent which proved useful with regard to the South American venture, since one of the few things he was able to salvage in the disaster on his way home was his collection of drawings of fishes and palms. There was also the matter of the sheer bulk of materials that he collected, which included thousands of organisms new to science. That Wallace enjoyed some respect in the field of systematics is indicated by his presidency of the Entomological Society of London in 1872. For many years his revisions of existing classifications appeared with considerable regularity in the major journals of the period.

He is better known, however, for his descriptive zoogeography. Although he was quoted as saying that he never had the patience necessary for the collection and assemblage of facts and details (an obvious and fair concession to Darwin), the geographical zoology section of *The Geographical Distribution of Animals* certainly seems to qualify as an example of such work; it was not only the first compilation of this type for the animal kingdom as a whole, but so far had proved to be the last one. Despite the fact that it is now over 100 years old (and was never revised), it is still one of the most commonly referred to works in the zoogeographical literature. Wallace's compilation was organized geographically; that is, upon a regional classification scheme developed by P.L. Sclater for birds and modified and expanded upon by Wallace himself. Though Wallace was quite aware of the generally subjective basis of his regional scheme, through the use of comparative statistics (he was also a pioneer here) he was able to defend its appropriateness well enough to the extent that it is still the preferred systemization of world faunal regions. Part of the success of the classification stemmed from its recognition of substantial breaks in the characteristics of distribution between neighbouring regions. One of the most obvious of these appeared in the area with which he was personally familiar, the Malay Archipelago, and his consideration of it earned, thanks to Thomas Huxley's tag, the name 'Wallace's line'. This most famous of biogeographical boundaries separated the largely Australian-derived faunas to the east from the largely Oriental-derived faunas to the west.

c. Anthropology

Wallace's anthropology, unique for its time, was a curious mix of his understanding of the importance of cultural and biological diffusion and evolution and his firm idealism as to the basic equality of all men. Large sections of his travel books are devoted to description of the *mores* of the native peoples he encountered in his journeys; there is in these writings not the slightest trace of an attitude of superiority, disgust, or condescension. But Wallace was more than a raconteur when it came to anthropology. As a physical anthropologist, his importance lies mainly in his opinions on the origin of man by natural selection, but his break with Darwin over the issue of cultural evolution was supported by many, including Charles Lyell and Peter Kropotkin (the latter's *Mutual Aid* contains many references to Wallace's studies). Another of his contributions was the opinion, contrary to the time, that the peoples of the Australasian region were originally of Caucasian stock. His descriptions of the behaviour and ecology of the orangutan were among the first studies of this primate; he also published work on the affinities of monkeys.

Wallace also contributed to ethnography and linguistics. Drawing on his understanding of the principles of organismal dispersal, he interpreted the pattern of peoples and cultures in the Australasian region as being a result of a recent mass diffusion event. It was probably for this reason that he seemed to be so interested in the trade patterns among the islands of the Malay Archipelago, on which he included comments

in both his travel books and individual papers related to the subject. He also considered communication in the individual sense, advancing ideas on the nature of the languages of the peoples he came to know. The most important of these ideas was introduced in a review of his friend E.B. Tyler's fine work *Anthropology* in 1881. In this review, he set out the still important gestural theory of language, which he later expanded in a separate paper in 1895.

d. Geography I: Biogeography

To understand Wallace's importance to the development of the field of biogeography, it is first necessary to realize how central the notion of a theory of organic change is to the explanation of organismal distributions. Wallace, unlike Darwin, was aware of this connection even before he first set out on his collecting expedition to South America; in fact, he wished to be able eventually to deduce the properties of the former from the characteristics of the latter. That he was eventually able to set out a reasonable process theory using this approach is a testimony to his powers of observation. Before Wallace's time, it had been necessary to interpret present distributions from a creationist viewpoint. Two general variations in mode of explanation existed: one in which a past Creation or Creations had been followed by a diffusion of types away from a single or multiple points of origin, and a second in which a past Creation or Creations had directly produced today's patterns. Apart from his many specific contributions to biogeography, Wallace must be credited with presenting the first unified interpretation of organic distribution characteristics that was inherently dynamic in nature. As most of his studies involved animals, he is in particular considered to be the 'father' of modern zoogeography. Wallace viewed the history of life from a geographical perspective, as a gigantic diffusion process in both space and time fuelled by the tendency of living things to evolve adaptational strategies according to opportunity, and permitting them to continue to survive under ever-changing environmental conditions. To understand the results of this process (that is, present distributions), it was necessary to reconstruct for any particular faunal condition the chain of interacting historical constraints that was responsible for the degree of uniqueness observed at that place. Wallace discusses these individually in the first portion of *Animals*, especially dwelling on the importance of the interpretation of the spatial distribution of fossil forms related to those then extant. He then applies this understanding to the interpretation of the nature of the regional faunas of the world in his section on 'zoological geography', which, massively ambitious, is in achievement a world historical geography of animal life.

In *Island Life* Wallace took his analysis a step further. After reviewing the general facts of distribution, he proceeds to an in-depth examination of the main influences upon them, including organic evolution, the varying powers of dispersal among animals and plants, the general stability of the continental masses, climatic change, and time. In doing so, he dwells on evidence supporting the permanence of continents, reviews then existing theories of glaciation and introduces some of his own, and considers the problem of discontinuous distributions (which he supposes are a 'necessary result of "evolution"'). Most of the rest of the work is given to a treatment of representative island faunas, but there is also an important analysis of the specific means by which latitudinal changes in biotic distributions over time might be accomplished.

On this latter question, his opinion differed from Darwin's. Darwin was inclinded to believe that disjunct relict plant populations were an indication that far northern climates once had existed at low latitudes. Wallace felt instead that such distributions could be explained on the basis of movements along marginal environments that had varied over time. The two also disagreed as to how biotic propagules might typically reach remote island locations. Wallace felt that windborne seeds could explain most of such situations; Darwin favoured transportation by birds and ocean currents. Darwin also adhered less strongly than Wallace to his own idea that evolution would tend to proceed more slowly the larger the area involved. On such questions, Wallace's views have more often than not ended up as the favoured interpretations. This is not surprising, given his relatively greater interest in, and attention to, the spatial aspects of the evolutionary process.

e. Geography II: Physical Geography

Wallace was largely self-taught in geology; like Darwin, he attributed a good portion of his fundamental beliefs on this subject to the uniformitarian views of Charles Lyell. This understanding also constituted the basis for his ideas on the evolution of the earth's surface. His contributions to the field of physical geography are very numerous, though individually not of front rank. His first major paper on the subject, 'On the physical geography of the Malay Archipelago', nevertheless stands as a classic synthesis of historical geology and regional paleogeography. The general tone of this work gives us an idea of how his planned monograph study on the physical geography of the Amazon Basin might have turned out had all his notes on the area not been lost.

Wallace's studies in physical geography were published over a period extending from the 1860s to the 1890s: several were inspired by the vacations and botanizing tours in Switzerland of 1867 and 1895 and to the English Lake District in 1894. The first chapter of *Tropical Nature* is given over to a consideration of the causes of differences between tropical and temperate climates. In the same collection, the last chapter is devoted to the use of biotic distributions in assessing paleogeographic change. In *Island Life*, he assembled a variety of powerful arguments for the basic permanence of the continental masses. In the same work, he adopted Darwin's island classification scheme and showed how this could be related to the differing faunal characteristics among islands. *Island Life* also contains a discussion of the probable effect of glaciations on faunal change, and comments on the causes of glaciation itself. Concerning the latter, Wallace extended previous understandings by showing that the then popular astronomical theories of causation were incapable of explaining why glacial conditions had not existed throughout history. This discussion

is filled with innovative thoughts on the relationship between glaciations and land-sea area distribution, the theory of interglacial periods, the effect of changing currents on the distribution of ice sheets, the denudation cycles associated with alternating glacial and interglacial periods and their accompanying sea level changes, and the synergistic effect of meteorological conditions in contributing to ice accumulation and climatic change. In a two-part paper published in 1893, Wallace introduced the now accepted theory behind the manner of formation of glacial lake basins. In a pair of notes published in *Nature* in 1892, he provided a succinct explanation for the seeming paradox concerning the differing rates of denudation and sedimentation on the earth's surface. In the same year, he was one of the first to adduce evidence for a pre-Pleistocene glaciation epoch by noting the existence of glacial conglomerates of Paleozoic age in Australia. Various other papers were concerned with the subjects of evidence for glaciations in the Southern Hemisphere, the permanence of ocean basins, the theory of glacial motion, ocean circulation patterns, the formation of mountains, and the age of the earth.

f. Geography III: Geographical Education and Social Issues

There can be little doubt that Wallace considered a working knowledge of geographical principles to be of great general importance to the education of an individual. This is nowhere better indicated than in his autobiography, *My Life*, in which he spends a full thirteen pages describing his experiences during twenty-seven years as an Assistant Examiner in physical geography and physiography. Also in *My Life* is a summary of his ideas, published earlier, on Elisée Reclus' suggestion that a large model of the earth be built for general instructional purposes. Two more practical contributions, however, were his invention of the faunal diorama, an exhibit type now used by most natural history museums in which the fauna and flora of a given locality are represented in as life-like a fashion as possible, and his more general suggestions on how to organize museum collections as geographical information systems. But undoubtedly his largest contribution to general geographical education came through his travel works. A number of these were short pieces written while he was still in the field, but he also published three full books, one each on his experiences in South America and the Malayan region and one on Australasia as part of a travel series. As Wallace was not only an astute observer but an unusually fine writer as well, the influence of these works on both the general public and a whole generation of tropical naturalists must have been considerable. *The Malay Archipelago* in particular stands out as both his most successful book overall and one of the best scientific travel books ever written.

The extent of Wallace's consideration of social issues cannot be reasonably synopsized here, but at least one of his concerns directly involving a geographical theme should be mentioned. This was his considerable interest in the matter of land ownership and planning. Although he had been exposed to the ideas of Robert Owen and Herbert Spencer at an early age, it was not until the late 1870s that he developed a real concern over the need for land tenure reform. The thinking out of solutions to the problem slowly but surely turned him into a confirmed socialist; along the way, he expressed many views that were largely unpopular at the time. In *Land Nationalisation* he opined that unrestricted private ownership of land was wrong, that historically important structures should be purchased by the state to prevent their deterioration, that ownership of land should revert to the state, and that green belts and parks should be established between cities for recreational and educational purposes. In applying for the job of superintendent of Epping Forest, he wrote an essay (1878) which outlined his plans to turn the tract into a botanical garden featuring elements of all the world's floras. More of Wallace's wide-ranging views on social injustices may be found in *Bad Times*, *The Wonderful Century*, *Studies Scientific and Social*, *Social Environment and Moral Progress*, *The Revolt of Democracy*, *My Life*, and numerous shorter works.

3. INFLUENCE AND SPREAD OF IDEAS

No one has ever done a wholly adequate study of the overall importance and influence of Wallace's ideas. Certainly this would be an immensely interesting project, for one would have to consider at once in assessing such the following factors affecting the ultimate impact of his views on a diverse potential audience: (1) his unusual status as a Victorian intellectual of low social station; (2) his lack of association with any institution of learning and resulting dearth of students; (3) his unenviable role historically as 'the other man' in the elucidation of the theory of natural selection; (4) his contacts with the leaders of the English intellectual community for some fifty years; (5) his expertise as a writer; (6) his constant representation in the literature of several different fields (in no five year period from 1852 to the year of his death did he ever produce fewer than twenty publications); (7) his unabashed defence of a number of unpopular social and scientific causes; (8) the indirect influence he had through his travel works and the opportunities afforded to the many specialists who studied the elements of his collections; and (9) his personal character. Regardless, with respect at least to the development of mid-nineteenth century evolutionary theory, his importance can be considered as second only to Darwin's. And it is a further tribute to both men that many of the same major issues over which they disagreed are still active subjects of debate.

Neither has there ever been a study of Wallace's specific influence upon the development of geographical thought. He has usually been considered a naturalist, and the subject dropped at that point. Nonetheless, there are enough bits of evidence about to suggest that the impact of his thoughts on the field has not been trivial. There are of course his direct contributions, many of which were mentioned earlier. Wallace's influence on the most important contributors to late ninteenth and early to mid twentieth century zoogeographical theory is quite apparent: virtually every discussion within zoogeography over that period

had to involve his ideas on the subject. His supporters have included Richard Lydekker, P.L. Sclater, W.D. Matthew, George Gaylord Simpson, Ernst Mayr, and P.J. Darlington; his works are still commonly referred to both for the reason that they contained so many innovations and that so many of them still seem, over 100 years later, appropriate to our understanding of organic distribution. His contributions to physical geography have seemingly made little overall impact; Chorley, Dunn, and Beckinsale's *The History of the Study of Landforms* contains not a single reference even to his glacial studies despite the fact that these are noted in some early texts such as Geikie's *Earth Sculpture* and in Davis' collection, *Geographical Essays*. This would seem to be something of an oversight, though it must be remembered that most of what Wallace had to say came directly out of his powers of reasoning rather than as a result of field-based investigations devoted specifically to the testing of related ideas.

Apart from his zoogeography, it may be in the example set by his synthetic methodologies that Wallace's greatest impact on geography has come. In providing a general means of applying the historical approach to the study of present day patterns, Wallace became one of the first great space-time synthesizers. His differentiation between the meaning of 'zoological geography' and 'geographical zoology' was as astute a relating of the regional geography and systematic geography approaches as any ever made. Hartshorne notes this in *The Nature of Geography* in commenting on Hettner's debt to the same, but the story possibly goes much further than this. Hettner for a time studied with Friedrich Ratzel, the great German geographer and anthropologist. Ratzel's exposure to Wallace's ideas soon after obtaining his doctorate appears to have made a profound impression on him; in fact, shortly thereafter Ratzel gave up a just-starting career in zoology to turn to travel, geography, and ethnography. Three of Ratzel's first journal publications (in 1870) consisted of commentaries on some of Wallace's ideas; the former appeared in print less than a year after the German translations of *Contributions to Natural Selection* and *The Malay Archipelago* were issued. Even more interestingly, Ratzel soon turned his attention to the cultural diffusion of peoples and customs, studying the areas and peoples among whom Wallace had spent so much time and on whom he had written so much. As this work provided the impetus for the development of the most important school of anthropology in the late nineteenth and early twentieth centuries, it is not unreasonable to view Wallace as an important influence on its evolution.

Bibliography and Sources

1. REFERENCES ON ALFRED RUSSEL WALLACE

Beddall, B.G., 'Wallace, Darwin, and the theory of natural selection', *J. Hist. Biol.*, vol 1, (1968), 261-323

Beddall, B.G., ed., *Wallace and Bates in the Tropics; An Introduction to the Theory of Natural Selection*, London (1969)

Brackman, A.C., *A Delicate Arrangement; The Strange Case of Charles Darwin and Alfred Russel Wallace*, New York (1980)

Eiseley, L., *Darwin's Century; Evolution and the Men who discovered it*, New York (1958)

Fichman, M., 'Wallace: zoogeography and the problem of land bridges', *J. Hist. Biol.*, vol 10/1 (1977), 45-63

George, W., *Biologist Philosopher; A Study of the Life and Writings of Alfred Russel Wallace*, London (1964)

Henderson, G.M., *Alfred Russel Wallace: His Role and Influence in Nineteenth Century Evolutionary Thought*, Ann Arbor, Michigan (1958: unpublished dissertation)

Kottler, M.J., 'Alfred Russel Wallace, the origins of man, and spiritualism', *Isis*, vol 65, (1974), 145-92

McKinney, H.L., *Wallace and Natural Selection*, New Haven (1972)

Marchant, J., *Alfred Russel Wallace; Letters and Reminiscences*, New York (1916)

Osborn, H.F., *Impressions of Great Naturalists* (2 ed.), New York (1928)

Smith, R., 'Alfred Russel Wallace: philosophy of nature and man', *Brit. J. Hist. Sci.*, vol 6, (1972), 178-199

Tuan, Yi-Fu, 'Latitude and Alfred Russel Wallace', *J. Geogr.*, vol 62, 258-61

Wallace, A.R., *My Life; A Record of Events and Opinions* (2 vol.), London (1905)

2. SELECTIVE BIBLIOGRAPHY OF WORKS BY ALFRED RUSSEL WALLACE

Wallace published some 500 monographs, articles, notes, letters and reviews during his lifetime, including over 100 in the journal *Nature* alone. Readers are asked to note that as many of Wallace's works are interdisciplinary in scope, their listing in the following categorical divisions is somewhat arbitrary.

a. Physical geography and geology

1863 'On the physical geography of the Malay archipelago', *Proc. R. Geogr. Soc.*, vol 7, 205-12

1867 'Ice marks in North Wales', *Q. J. Sci.*, vol 4, 33-51

1870 'The glaciation of Brazil', *Nat.*, vol 2, 510-12

1871 'The theory of glacial motion', *Nat.*, vol 3, 309-10

1872 'Ocean circulation', *Nat.*, vol 6, 328-9

1876-7 'The comparative antiquity of continents, as indicated by the distribution of living and extinct animals', *Proc. R. Geogr. Soc.*, vol 21, 505-35

1879 'Glacial epochs and warm polar climates', *Q. Rev.*, vol 148, 119-35

1892 'The permanence of the great oceanic basins', *Nat. Sci.*, vol 1, 418-26

---- 'The earth's age', *Nat.*, vol 47, 175, 227

---- 'An ancient glacial epoch in Australia', *Nat.*, vol 47, 55-6

1893 'The ice age and its work', *Fortn. Rev.*, vol 54 n.s., 616-33, 750-74
---- 'Inaccessible valleys - a study in physical geography', *Nineteenth Century*, vol 33, 391-404
---- 'The glacial theory of alpine lakes', *Nat.*, vol 47, 437-8; vol 48, 198
---- 'The origin of lake basins', *Nat.*, vol 49, 197, 220-1
1896 'The cause of an Ice Age', *Nat.*, vol 53, 220-1

b. Biogeography
1859 'On the geographical distribution of birds', *Ibis*, vol 1, 449-54
1860 'On the zoological geography of the Malay archipelago', *J. Proc. Linn. Soc. Lond.*, vol 4, 172-84
1876 *The geographical distribution of animals*, 2 vol, London, 503 and 607 p.
1877 'The comparative richness of faunas and floras tested numerically', *Nat.*, vol 17, 100-01
1878 'Epping Forest', *Fortn. Rev.*, vol 24 n.s., 628-45
1879 'Animals and their native countries', *Nineteenth Century*, vol 5, 247-59
1880 *Island Life*, London, 526 p.
1883 'On the value of the "Nearctic" as one of the primary zoological regions', *Nat.*, vol 27, 357-68, 485-93
1894 'What are zoological regions?', *Nat.*, vol 49, 610-13
---- 'The Palaearctic and Nearctic regions compared as regards the families and genera of their mammalia and birds', *Nat. Sci.*, vol 4, 433-45

c. Evolutionary studies
1855 'On the law which has regulated the introduction of new species', *Ann. Mag. Nat. Hist.*, vol 16, 184-96
1858 'Note on the theory of permanent and geographical varieties', *Zoologist*, vol 16, 5887-8
1859 'On the tendency of varieties to depart indefinitely from the original type', *J. Proc. Linn. Soc. Lond.*, vol 3, 53-62
1865 'On the phenomena of variation and geographical distribution as illustrated by the Papilionidae of the Malayan region', *Trans. Linn. Soc. Lond.*, vol 25, 1-71
1869 'Geological climates and origin of species', *Q. Rev.*, vol 126, 359-94
1870 *Contributions to the theory of natural selection*, London, 384 p.
1880 'The origin of species and genera', *Nineteenth Century*, vol 7, 93-106
1880-1 'Geological climates', *Nat.*, vol 23, 124, 217, 266-7
1889 *Darwinism*, London, 494 p.

d. Anthropology and linguistics
1864 'The origin of human races and the antiquity of man deduced from the theory of natural selection', *J. Anthropol. Soc. Lond.* vol 2, clvii-clxxxvii
1864-5 'On the varieties of man in the Malay archipelago', *Trans. Ethnol. Soc. Lond.* n.s., vol 3, 195-215
1867 'The Polynesians and their migrations', *Q. J. Sci.*, vol 4, 161-6
1879 'New Guinea and its inhabitants', *Contemp. Rev.*, vol 34, 421-41
1881 'Anthropology', *Nat.*, vol 24, 242-5
1882 'Monkeys', *Contemp. Rev.*, vol 41, 417-30
1895 'The expressiveness of speech, or mouth-gesture as a factor in the origin of language', *Fortn. Rev.*, vol 58 n.s., 528-43

e. Social issues
1880 'How to nationalise the land', *Contemp. Rev.*, vol 38, 716-36
1882 *Land nationalisation, its necessity and its aims*, London, 240 p.
1883 'The "why" and the "how" of land nationalisation', *MacMillan's Mag.*, vol 48, 357-68, 485-93
1885 *Bad Times*, London, 118 p.
1898 *Vaccination a delusion*, London, 96 p.
---- *The wonderful century*, New York, 400 p.
1913 *Social environment and moral progress*, London, 163 p.
---- *The revolt of democracy*, London, 122 p.

f. General works
1850 'On the umbrella bird (Cephalopterusornatus) "Veramimbé" L.G.', *Proc. Zool. Soc. Lond.*, vol 18, 206-07
1853 *Palm trees of the Amazon and their uses*, London, 129 p.
---- *A narrative of travels on the Amazon and Rio Negro*, London, 541 p.
1869 'Museums for the people', *MacMillan's Mag.*, vol 19, 244-50
---- *The Malay archipelago*, London, 2 vol
1878 *Tropical nature and other essays*, London, 356 p.
1879 *Australasia*, London, 672 p.
1887 'American museums', *Fortn. Rev.*, vol 42 n.s., 347-59, 665-75
1900 *Studies scientific and social*, London, 2 vol
1903 *Man's place in the Universe*, New York, 326 p.
1905 *My life; a record of events and opinions*, London, 2 vol, 435 and 459 p.
1910 *The world of life*, London, 400 p.

3. UNPUBLISHED SOURCES ON ALFRED RUSSEL WALLACE

Lists of such sources may be found in the Brackman and McKinney monographs cited in Section 1

Charles Hyde Smith is a Ph.D. candidate and teaching assistant at the University of Illinois at Champaign-Urbana, Illinois

Chronology

1823	Born at Usk, Monmouthshire, 8 January
1836	Leaves school

1838	Joins older brother William as apprentice surveyor
1844	Obtains teaching post at Collegiate School, Leicester; meets H.W. Bates
1848-52	Natural history collecting expedition to South America with Bates
1852	Loses collections at sea on return trip to England
1854-62	Natural history collecting expedition to the Malay Archipelago
1858	Ternate paper on natural selection sent to Darwin, read before the Linnean Society
1862	Returns to England; first formal meeting with Darwin
1866	Marries Annie Mitten
1867	Switzerland excursion
1870-71	Assistant Examiner in Physical Geography and Geology for the Royal Geographical Society
1871-97	Assistant Examiner in Physical Geography, Geology, and Astronomy under the Science and Art Department
1872	President, Entomological Society of London
1876	President, Biological Section of the British Association at Glasgow
1877	'Botanizing tour' in Belgium
1878	Fails in bid for post of superintendent of Epping Forest
1881	(First) President, Land Nationalisation Society
1886-87	North American lecture tour
1893	Elected Fellow of the Royal Society; receives visit from Elisée Reclus
1894	Holiday with wife in Lake District
1895	'Botanizing tour' in Switzerland
1913	Dies at Old Orchard, Broadstone, 7 November