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Boats, Birds and Peoples of Paradise

Alfred Wallace could be pardoned for feeling paranoid about ships. Every time he undertook a major voyage something seemed to go wrong. From Sarawak, he intended to travel to Macassar (Ujung Pandang), the capital of the island of Celebes (Sulawesi), one of the areas in the archipelago least-explored by European naturalists. Because of the prevailing wind patterns, this meant heading to Singapore to catch one of the occasional vessels that departed from there, but he missed his intended ship by a day. Another wasn't expected for weeks, or even months.

While waiting, he resumed insect hunting and polishing his Malay. But it was a frustrating time. The monsoon was now blowing in the teeth of the course his ship would take. It was recommended he go to Bali or Lombok instead, ports better located for suitable trading ships to Celebes. He might be lucky.

Luck and ships were not a combination Wallace trusted, and he had no particular interest in visiting Bali, which he knew to resemble Java, the most studied region of the archipelago. Still,

there was no point staying where he was. He reached Bali on 13 June 1856, after a twenty-day passage in a schooner that exemplified the multicultural East. Called the *Rose of Japan*, it was owned by a Chinese merchant, captained by an Englishman and manned by Javanese sailors.

As he'd expected, Bali, though attractive with its ancient Hindoo temples, proved relatively uninteresting to a collector. The island's intense cultivation meant that birds and insects – mostly commonplace species of the Indian region – were scanty. And no ships to Celebes were expected in the immediate future.¹

After two days, Wallace decided to cross the fifteen-mile strait to look for a passage from the port of Ampanum, on the island of Lombok. During the short sail, he could see across both coastlines to admire twin, 8000-foot volcanos, their spires covered in cloud and their foothills speckled with colour by the tropical sun. But the Lombok shipping news wasn't good either. Once again he'd narrowly missed a trading ship to Macassar and would have to wait several months to catch another. This time, however, Wallace's boat curse proved to be a scientific blessing.

Though it took him a few weeks to realise it, the gods of luck had taken pity on him. Finding few birds and insects around the town of Ampanum, Wallace and his young Malay assistant Ali, who had replaced the useless Charles, together with a Malaccan shooter, caught a native outrigger for a day's rowing to the southern extremity of the bay, where the uncultivated country was said to be rich in birds. After hiring a single room in a bamboo house, he began to explore the hinterland.

The countryside differed from cultivated Bali. Flat valleys and open plains rose up to steep volcanic hills 'covered with a dense scrubby bush of bamboos and prickly trees and shrubs'. But it was the bird life that proved a shock: 'I now saw for the first time the many Australian forms that are quite absent from the islands westwards.'²

With these understated words, Wallace had announced one of the most important scientific discoveries of his life.

Australian bird species were everywhere. The white cockatoo, with its arrogant sulphur-yellow crest, was impossible to miss. Wallace noted a behaviour pattern familiar to every Australian. 'Instead of flying away when alarmed as other birds do, it circuits round and round from one tree to another, keeping up such a grating, creaking, tympanum-splitting scream, as to oblige one to retire as soon as possible to a distance.'³

Less flamboyant but stranger still was the *Megapodius gouldiae*, a brown, hen-like bird with long orange feet and curved claws. Rather than hatching its eggs with body heat, it scratched up a huge mound, around twelve feet across and six feet high, using sand, soil, shrubbery and any rubbish it could find. Inside this, after testing the internal heat, it buried a clutch of brick-red eggs to hatch on their own.

Wallace knew this scrub fowl belonged to a family of birds found nowhere else but Australia and its surrounding islands. What on earth was it doing here in the heartland of South-East Asia, yet absent from Bali, only fifteen miles away? The same held for many other birds: large green pigeons, kingfishers related to the 'great Laughing Jackass of Australia' (the kookaburra), green bee-eaters, multicoloured ground thrushes, little crimson and black flower-peckers, metallic-coloured king crows, golden orioles, and 'fine jungle cocks – the origin of all our domestic breeds of poultry'.⁴

Finding a jungle cock gave Wallace a chance to do a favour for the celebrated naturalist Charles Darwin, who had in 1855 sent him and other collectors a letter asking if they could provide samples of foreign domestic birds for experiments he was undertaking in selective breeding. Wallace did not know that Darwin's experiments were aimed at showing how selective breeding altered domestic bird species in the same way that nature's evolutionary processes originated new wild species.

The obscure young collector was of course flattered to be asked, even though Darwin got his name slightly wrong. He sent Darwin a domestic duck from Bali and a wild jungle fowl from Lombok. Wallace didn't yet feel confident to tell the great naturalist that he believed he'd discovered a key natural boundary – the geographical line that marked the division between the faunal regions of Asia and Australia.

It hadn't taken Wallace long to realise the implications of Lombok's distinctive birds. Boundaries were his speciality; as a surveyor, he'd accrued years of experience in framing maps and demarcating limits.⁵ In faunal terms, Asia and Australia faced each other across a fifteen-mile moat. As one modern authority says, Wallace had stumbled on a point 'where worlds collide'.⁶ And what different worlds they were: Asia contained numerous large mammals, Australia 'scarcely anything but marsupials', none of which were found in Asia. Australia was the richest tropical region in the world for parrots, Asia was the poorest, and so on. A ribbon of water separated two of the most dissimilar faunal regions on the globe.

Wallace wrote to tell his close friends Samuel Stevens and Henry Bates of his discovery. To them he didn't have to labour the fact that it undermined one of the central tenets of creation theory – namely, that similar species had been created by God within similar environments. As he told Stevens, the islands of Bali and Lombok were almost identical in soil, climate, aspect and elevation, yet they differed utterly in their productions, 'and in fact belong to two quite distinct zoological provinces'.⁷ His subsequent letter to Bates spelt out the implications even more bluntly.

In this Archipelago there are two distinct faunas rigidly circumscribed, which differ as much as those of South America and Africa, and more than those of Europe and North America: yet there is nothing on the map or on the face of the islands to

mark their limits. The boundary line often passes between others closer than others in the same group. I believe the western part to be a separated portion of continental Asia, the eastern the fragmentary prolongation of a former Pacific continent.⁸

During the two and half months he was stranded in Lombok, Wallace worked to confirm his hypothesis. Six years later, Thomas Huxley would give this boundary, extending up from Lombok past the Philippines and Timor, the name 'Wallace's Line'. A present-day expert calls it 'the boldest single mark ever inscribed on the biogeographical map of the world'.⁹

Wallace himself remained unsatisfied that he'd solved all of its associated puzzles. On finally arriving at Celebes in September 1856, he encountered yet another biogeographical incongruity. With three indigenous helpers, including a new Malay cook, Baderoon, he set off to explore the interior. What he found there proved doubly disquieting. For a start, neither the villagers nor their domestic animals had seen a white man before and found the experience repulsive. 'I excited terror alike in man and beast,' Wallace admitted ruefully. 'Wherever I went dogs barked, children screamed, women ran away, and men stared as though I were some strange cannibal monster.'¹⁰

More startling was his realisation – confirmed on subsequent visits to Celebes – that the island was a faunal freak. It belonged neither to the Indian nor the Australian biogeographic regions. It wasn't even a hybrid of the two. For example, the island possessed a species of baboon, *Cynopithecus nigrescens*; a warthog-like creature with curved tusks and horns, the babirusa; and a type of wild cow, the anoa. None of these animals had anything in common with either Asiatic mammals or Australian marsupials.¹¹ The closest allied species of these Celebes creatures were found in tropical Africa, an ocean away.

In a later paper, Wallace called this the most anomalous distribution phenomenon known to man. The explanation, he suggested, must be that Celebes, being more ancient than its neighbours, had acquired its fauna before the surrounding islands were elevated from the seabed. It must have been part of a great continent situated in what was now the Indian Ocean: 'The Celebes group remains the last Eastern fragment of this now submerged land, or of some of its adjacent islands, indicating its peculiar origin by its zoological isolation, and by still retaining a marked affinity with the African fauna.'¹²

The existence of such a vast earlier continent also suggested possible analogies with the faunal regions of Australia and New Guinea, but these Wallace hoped to understand better at his next destination.

Wallace decided to leave Macassar in December 1856, when the four-month-long wet season set in. Black clouds crowded the sky, driving rain turned the fields into duck ponds. It was imperative to find a drier region for collecting. After considering the places that were reachable from this great native trade emporium, Wallace opted for the Aru Islands, off the south-west coast of New Guinea. Here, the weather would remain dry for months yet.

He had long regarded this area as the "Ultima Thule" of the East', because it lay beyond the reach of European control.¹³ From Aru, indigenous traders provided Europe and the East with exotic luxuries like tortoiseshell, mother-of-pearl, edible birds' nests, dried trepang (sea slug), and the feathers of the fabled bird of paradise. The last were a particular prize. Although these feathers had been reaching Europe for centuries, the skins and carcasses were invariably mangled by native hunters. Often their legs were chopped off for ease of transport, spawning a myth that the surreal birds

were forever in flight. Linnaeus, as a result, named the best-known species *Paradisea apoda* (meaning legless). By 1856, the birds were known to have legs, but no European had seen or studied them in the wild – a challenge that Wallace found irresistible.

For a man with his boating record, going to the Aru Islands was a bold decision. He would have to take a thousand-mile voyage in a Malay prau, and live for six or seven months among 'lawless traders and ferocious savages'. He would need to leave Macassar with the monsoon in December or January and return when the winds switched direction some six months later. Making this trip was regarded 'as a rather wild and romantic expedition', even by Macassar people.¹⁴

In the end, of course, this frisson of danger only added to the appeal. As the time to embark approached, Wallace began to feel as excited as a schoolboy allowed to travel beside the stagecoach driver for the first time.

When at last he clambered onto the prau at daybreak on 13 December 1856, Wallace found himself aboard a vessel that inverted every structural and social principle of British maritime practice. For a start, the owner-captain, a mild-mannered Javanese half-caste, asked Wallace to decide his own fee on completion of the return voyage. This same captain, Wallace observed, never shouted or flogged his sailors, wore only trousers and headscarf, and dined with the Bugis (Creole Chinese) members of his crew, even though they were technically criminals working off their debts by a stint of sailing. Much of the time, too, the captain ignored his compass, being content to maintain a true course by watching the swell of the sea.

The first mate, an old man known as the *jurugan*, who seemed to be the navigator, spent most of his time chanting, 'Allah il Allah,' and beating time with a small gong.¹⁵ Members of the piratical-looking crew felt free to give their opinions every time the boat

tacked, generating a babble of 'orders . . . shrieking and confusion'.¹⁶ At any given time, only a quarter of the crew were working; the rest dozed in the shadow of the sails, chatted and chewed betel in small huddles, or engaged in domestic chores like carving knife-handles and stitching shirts.

As for the ship itself, a giant, junk-like sailing canoe that drew around seventy tons, Wallace at first thought it 'an outlandish craft'. It had been built out of planks using no nails, and carried sails made of matting. The bow, which should have been high, was the lowest point of the boat; the rudders were situated amidships on cross-beams, rather than at the stern, and were held in place only by slings of rattan and the friction of the sea. In an exact reverse of British rigs, the long end of the mainsail was mounted high in the air, and the short end hauled down onto the deck. The tillers entered the boat through two square openings at the rear.

These last, Wallace discovered to his alarm, were only three feet from the surface of the water and completely open to the hold, 'so that half a dozen seas rolling in a stormy night would completely swamp us'. The prau's 'wilderness' of rattan and bamboo rigging, yards and spars seemed in a permanent tangle. The clock was half a coconut shell floating in a bucket – a small hole in the shell was designed to allow water to seep in at a calculated rate. Wallace's cabin consisted of a thatched hut four feet high on the deck, with a fringe of reeds over the entrance, and split-bamboo floors.¹⁷

Yet it worked. Wallace had never been more comfortable or relaxed on a long sea voyage. Though they were inundated with monsoon rains for the first five days, he read happily in his little 'snuggery'. The combination of bamboo, palm thatch, coir rope and vegetable fibres kept him dry, and smelt so sweet and natural that he was reminded of 'quiet scenes in the green and shady forest'. No stink of paint, tar, varnish, oil or grease assailed him.¹⁸

Soon they were bobbing through the waves at a steady five

knots, while he ate vegetables and fresh shark and listened to the crew's murmur of conversation and prayers. When they entered the Moluccan Sea at night, Wallace was entranced 'to look down on our rudders from which rushed eddying streams of phosphoric light gemmed with whirling sparks of fire'. The crew, despite comprising fifty 'wild, half-savage looking fellows' of several tribes and tongues, neither quarrelled nor fought. Wallace doubted whether Europeans would have behaved so well 'with as little restraint on their actions'. Even the coconut-husk clock never varied from Wallace's chronometer by more than a minute. As he watched flying fish skim through the air on hundred-yard flights, rising and falling like graceful swallows, it was as if the Malay prau sailed in harmony with the sea.¹⁹

New Year's Eve was celebrated at their first port of call, the Ke Islands, a mass of coloured limestone rocks, jutting peaks and pinnacles, tall screw pines and Liliaceae. Below these were little bays and inlets, with beaches of 'dazzling whiteness' and 'water . . . as transparent as crystal'. Wallace found it 'inexpressibly delightful' to be 'in a new world'. On seeing his first Papuan traders crowding around the prau's Malay crew, he decided that these were 'two of the most distinctly marked races that the earth contains'.²⁰ Was this another case of two worlds colliding?

The Papuans, 'intoxicated with joy and excitement', sang, shouted and shoved, touching everyone and everything. The Malays stood back, dignified, constrained, and rather affronted by such violations of their social protocol. During their four-day stay, Wallace collected a tally of thirteen species of birds, a hundred and ninety-four of beetles and three of land shells, his first specimens from within the Moluccas and New Guinea region. They included ruby and emerald beetles, splendid scarlet lories, and large handsome butterflies.²¹

On 8 January 1857, they anchored at the small trading settlement

of Dobbo on the Aru island of Wamma, after the most enjoyable voyage of Wallace's life. The prau and its crew became a symbol to him of all that was charming about the archipelago. He was also laying down ethnographic information that would later serve him and Darwin well.

Reflecting afterwards, Wallace decided it was the freedom from restraint, absurd dress codes and hierarchical pretension that had made the voyage so pleasant. As a result, 'the crew were all civil and good tempered, and with very little discipline everything went on smoothly . . . so that . . . I was much delighted with the trip, and was inclined to rate the luxuries of the semi-barbarous prau as surpassing those of the most magnificent screw-steamer, that highest product of our civilization'.²² As in the Amazon, using native sailing craft underscored his conviction that a naturalist could best understand new places by sharing the everyday life of the inhabitants, with all its perils, hardships and joys.

The same held for living on land. Having set himself up at Dobbo in a thatched bamboo shed on a spit of sand that merged with the beach, he turned his attention to the luxuriant forest behind. Chasing along the paths with his Malay assistant Ali, he discovered a collector's wonderland. Within a few hours he captured thirty new species of butterfly, and within three days the queen of them all – the great, bird-winged *Ornithoptera poseidon*. 'I trembled with excitement as I saw it coming majestically towards me, and could hardly believe I had really succeeded in my stroke till I had taken it out of the net and was gazing, lost in admiration, at the velvet black and brilliant green of its wings, seven inches across, its golden body and crimson breast.' It was like a gem shining in the forest gloom. 'The village of Dobbo held that evening at least one contented man.'²³

Boat being the only means of travel inland, Wallace was prevented for some weeks from going there by news that a fleet of pirates had been attacking and looting vessels near Dobbo. He eventually

procured a smaller prau to take him to the centre of the island. Here locals specialised in hunting the bird of paradise, inserting a cup-size conical wooden cap on the end of their arrows to minimise damage to the exquisite plumage. Even so, the birds were hard to come by and often mangled. After four months of false leads, Wallace's Malay cook and shooter, Baderoon, at last appeared one evening with a perfect specimen.

Most of the little bird's plumage was 'an intense cinnabar red', while the velvety feathers on its head shaded into glossy orange. From the breast downwards was a pure silky white crossed with a band of 'deep metallic green'. The same green surrounded the eye, contrasting with a vivid yellow bill and cobalt-blue legs. From under the wings came 'tufts of greyish feathers terminated by a broad band of intense green'. These feathers could fan out in a double curve, while the two middle feathers of the tail took the form of slender wires five inches long, which webbed at the end into 'a pair of elegant glittering buttons'.

It was 'the most perfectly lovely of the many lovely productions of nature,' and Wallace was the first man ever to send an unblemished specimen to Europe. He was also the first to describe the flamboyant courtship displays performed by the male birds, who fanned out their wings and plumes to entice female partners.²⁴ Many naturalists in Britain, however, were to regard this story as no less fanciful than the legend that birds of paradise were born without legs.

Though ecstatic at his encounter with these fabulous birds, Wallace was also eerily prescient about the significance of the occasion. The beauty of the birds moved him to melancholy reflections about the complexities and ironies of the natural economy.

It seems sad that on the one hand such exquisite creatures should live out their lives and exhibit their charms only in these

wild inhospitable regions . . . while on the other hand, should civilized man ever reach these distant lands, and bring moral, intellectual and physical light into the recesses of these virgin forests, we may be sure he will disturb the nicely-balanced relations of organic and inorganic nature as to cause the disappearance, and finally the extinction, of these very beings whose wonderful structure and beauty he alone is fitted to appreciate and enjoy. This consideration must surely tell us that all living things were not made for man. Many of them have no relation to him. The cycle of their existence has gone on independently of his, and is disturbed or broken by every advance in man's intellectual development; and their happiness and enjoyments, their loves and hates, their struggles for existence, their vigorous life and early death, would seem to be immediately related to their own well-being and perpetuation alone, limited only by the equal well-being and perpetuation of the numberless other organisms with which each is more or less intimately connected.²⁵

In spite of his utopian inclinations, Wallace was also a realist. He appreciated that life in this paradisiacal place often held severe drawbacks for the Aru Islanders. The abundant tropical fruits eaten by many of the tribes did not provide a complete diet; some sort of farinaceous supplement – such as grain or nuts – was needed, but few could find or afford it. Crippling ulcers on his own legs and feet were one result of this inadequate diet. Festering mosquito bites didn't help either. At one time he found himself laid up for six weeks on the island of Wanubai, unable to walk or travel. He noticed, too, that all the islanders lived in constant fear of attacks from pirates, who would periodically kill villagers and plunder the goods of trading praus.

Wallace had to admit that the traders were themselves an unlovely-looking bunch. The five hundred people who lived in Dobbo were 'types whom one is told have the worst reputation for morality – Chinese, Bugis, Ceramese, and half-caste Javanese,

with a sprinkling of half-wild Papuans from Timor, Babber and the other islands'. Yet living in a palm-leaf hut with an open entrance actually felt safer than when under the protection of London's metropolitan police. 'This motley, ignorant, bloodthirsty, thievish population live here without the shadow of a government, with no police, no courts, and no lawyers; yet they do not cut each other's throats, do not plunder each other day and night; do not fall into the anarchy such things might be supposed to lead to . . . It puts strange thoughts into one's head about the mountain-load of government under which people exist in Europe.'²⁶

On 2 July 1857, Wallace departed the Aru Islands, after one of the most successful collecting stints of his life. This time he sailed in an armada of fifteen praus so as to deter pirates. On board he carried a collection of nine thousand specimens, comprising sixteen hundred distinct species, and thanks to the smoothness of the voyage, he didn't lose any of them. After all his previous misfortunes, a little self-satisfaction could be pardoned.

I had made the acquaintance of a strange and little-known race of men; I had become familiar with the traders of the East; I had revelled in the delights of exploring a new flora and fauna, one of the most remarkable and least-known in the world; and I had succeeded in the main object for which I had undertaken the journey – namely to obtain fine specimens of the magnificent Birds of Paradise and to be enabled to observe them in their native forests . . . it is still the portion of my travels to which I look back with the most satisfaction.²⁷

Wallace arrived back at Macassar nine days later. During the next four months, he lived partly in the port and partly in the northern hinterland, where he stayed at a house on the edge of the forest with his two Malay servants. Here he collected some intriguing birds and insects, read and reread his books, and drafted letters and papers.²⁸

If it was a quiet time, and hence little noticed by his biographers, it proved intellectually profitable. Wallace, as Darwin had on returning from his *Beagle* voyage, was reflecting on his findings.

Having completed such a rich spate of collecting in the Aru Islands, he also needed to send a major consignment of specimens back to England. Preparing and dispatching this massive collection was an exhausting task, but it was worth the pain. London zoologists raved about the quality of his specimens.²⁹ Labelling, sorting and organising them also gave him an opportunity to ponder their relevance to the vexing issues of species change, divergence, extinction, adaptation and distribution.

If Wallace needed any further goad to renew his theoretical speculations, it came via a wad of letters that had accumulated in Macassar. Among them was a letter from Charles Darwin. Emboldened by having sent Darwin the specimens of native fowl he'd requested, Wallace had written to ask the great naturalist's opinion of his Sarawak Law paper of the previous year.

To Wallace's delight, Darwin said he agreed with almost every word. However, he couldn't resist also delivering the young collector a masked warning about impinging on established territorial boundaries: 'The summer will make the twentieth year (!) since I opened my first notebook on the question of how species and varieties differ from each other. I am now preparing my work for publication but I find the subject so very large, that though I have written many chapters, I do not suppose I shall go to press for two years.'³⁰ This seems to have been intended as grapeshot across Wallace's bow, but the latter interpreted it as an invitation to a dialogue with a man of mighty talent. In a subsequent letter to Henry Bates, Wallace commented that Darwin's massive work-in-progress 'may save me the trouble . . . by proving that there is no difference in nature between the origin of species and varieties'.³¹

This distinction lay at the heart of what both Darwin and Wallace

were trying to prove. Creationists believed that varieties were slight and temporary deviations from divinely fixed and eternal species. Darwin and Wallace believed that varieties were actually species in transition, and that ultimately both varieties and species were as plastic and mutable as each other, depending upon the natural forces that impinged on them.

Perhaps in support of Darwin's impending effort, Wallace fired off a short 'Note' to the *Zoologist*. In it, he called on British naturalists to acknowledge that there was no qualitative difference between varieties and species. Although species were alleged to have been created in fixed form by God, and varieties to have arisen naturally through 'ordinary generation', in practice the two forms often differed from each other only in minute and indefinable ways. Why, Wallace asked, tramping as usual where angels feared to tread, 'should a special act of creation be required to call into existence an organism differing only in degree from another which has been produced by existing laws?'³²

Wallace's target was not of course Darwin, whom he now suspected held similar views to himself, but the august geologist Sir Charles Lyell. Wallace regarded Lyell's *Principles of Geology* as foundational to understanding the interlocking process of geological and organic change in time and space. But it was precisely the brilliance of the book that made Lyell's continuing support for the doctrines of 'special creations' and 'fixity of species' so frustrating. It was as if Lyell had led disciples like Darwin and Wallace out of the wilderness to the brink of understanding the origin of species, then suddenly turned his back on them. His book had illustrated all the geological preconditions of change that made evolution possible and necessary, but, as an ardent Christian, he had been unable to take the last and logical step. The thought that man might be descended from an animal remained deeply repugnant to him. Oblivious of his own presumption, Wallace thus decided to use Lyell's methods in order to attack the doctrine of special creations.

Wallace's 'On the Natural History of the Aru Islands', published in the *Annals and Magazine of Natural History* in late 1857, opened by pointing out the commonality of fauna between New Guinea and Aru, despite their separation by a hundred miles of sea. Using a Lyell-style geological approach, Wallace deduced that the Aru Islands and New Guinea must once have been joined. To the west of the islands was the 'fathomless Molucca sea', yet soundings made eastward from New Guinea and southward from Australia revealed a uniform shallow depth of around thirty fathoms. Gradual subsidence must therefore have submerged what was once a shelf of connecting land.

Furthermore the strong affinity between Australian and New Guinea faunas, and their distinctiveness from most of the rest of the Malay Archipelago, suggested that Australia, New Guinea and the Aru Islands had once all been part of the same vast continent, sharing common climates and physical features. Soon after their separation, New Guinea and Australia had then experienced changes in their climates: one became jungle, the other largely desert. Extinctions followed in both places.

Here, however, Wallace deviated fundamentally from his geological guru. Over time, he argued, new species grew up alongside allied pre-existing ones in each place. As further time passed, these species in turn developed peculiarities suited to their new habitats. This evolutionary process, Wallace believed, explained the facts of species distribution far more logically than did the orthodox belief that divine creations had occurred in three widely separated places – countries which no longer even shared similar physical environments.³³

There's no doubting that Wallace was on an intellectual charge when he left Celebes in November 1857. We can sense his excitement and anticipation crackling through the papers he wrote there. He was getting close to the mystery of evolution and he knew it.

One aspect of his recent findings nagged at him particularly: 'The problem . . . was, not only how and why do species change, but how and why do they change into new and well-defined species, distinguished from each other in so many ways; why and how do they become so exactly adapted to distinct modes of life; and why do all the intermediate grades die out (as geology shows they have died out) and leave only clearly-defined and well-marked species, genera and higher groups of animals.'³⁴

After a short but fruitful time visiting the island of Amboyn (Ambon), Wallace decided to make a sustained exploration of the Moluccas and New Guinea. He arrived in Ternate on his thirty-fifth birthday, 8 January 1858, having chosen this picturesque volcanic island partly because of its proximity to 'the large and almost completely unknown island of Gilolo', but also because, as the ancient but now ruined centre of the European spice trade, Ternate was likely to possess long-term accommodation. To this end, Wallace carried a glowing letter of introduction to Meneer Duivenboden, known as 'the King of the Island'.

This cultivated son of an old Dutch family was as paradoxical a figure as Rajah Brooke of Sarawak. Although a rich slave-owner and adventurer-trader who held possession of half the town – also called Ternate – he was humane and generous. He was also fluent in English and well read in science and literature. Through his offices, Wallace obtained a rambling, rundown house; it was spacious and well situated, with abundant good drinking water, and it would serve as his base for the next three years.³⁵

Wallace's movements in the first three months of 1858 are obscure because he moved back and forth several times between Ternate and Gilolo Island, and because another bout of malaria disrupted his usual meticulous note-keeping. Some time in late January, he travelled to Gilolo on a local boat owned by a Dutchman with a Chinese captain and a crew of Papuan slaves. This ethnic diversity

was more than a curiosity, because Wallace was at the time thinking hard about racial as well as zoological lines of distribution.

During his Aru Islands trip, he'd become fascinated with the origins of the Malay tribes and their relation to Papuans.³⁶ Now, after travelling inland from Gilolo to the tiny village of Dodinga, he was struck by the cultural and ethnic divisions that striated this island. Curiously, Dodinga was occupied entirely by Ternate men, while the true indigenes, the Alfuros, lived only on the eastern and northern coasts. At another village, Sahoe, twelve miles away, he finally encountered the Alfuros, most of them working as traders or labourers for local Chinese and Ternate people.

Examining them carefully, Wallace became convinced that they were 'radically distinct from all the Malay races'. Their features and behaviour were unquestionably Papuan, their somewhat frizzy hair 'semi-Papuan', yet their light skin was Malay-like. Here, in a place where nobody expected it, he believed he'd found another 'exact boundary line', this time between 'the Malay and Papuan races'.³⁷

Returning to his small house in Gilolo some time in February 1858, he was revisited by malaria. While running a fiery temperature and experiencing intermittent hot and cold shakes, he lay on his bed helplessly and pondered 'any subjects then particularly interesting to me'. What happened next was not written down until many years later:

... something brought to my recollection Malthus's "Principles of Population", which I had read about twelve years before. I thought of this clear exposition of "the positive checks to increase" – disease, accidents, war, and famine – which keeps down the population of savage races to so much lower an average than that of more civilized peoples. It then occurred to me that these causes or their equivalents are continually acting in the case of animals also; and as animals usually breed much more rapidly than does mankind, the destruction every year from these

causes must be enormous in order to keep down the numbers of each species, since they evidently do not increase regularly from year to year, as otherwise the world would long ago have been densely crowded by those that breed most quickly. Vaguely thinking over the enormous and constant destruction which this implied, it occurred to me to ask the question, why do some die and some live? And the answer was clearly that on the whole the best-fitted live. From the effects of disease the most healthy escaped; from enemies, the strongest, the swiftest, or the most cunning; from famine, the best hunters or those with the best digestion; and so on. Then it suddenly flashed upon me that this self-acting process would necessarily *improve the race*, because in every generation the inferior would inevitably be killed off and the superior would remain – that is, the *fittest would survive*.³⁸

Biographers have puzzled over what put Malthus's *Principle of Population* into Wallace's feverish brain on this remote Moluccas island. One intriguing suggestion has come from historian James Moore, who argues that the conditions Wallace encountered in Ternate and Gilolo were reminiscent of the turbulent period of his youth when he'd seen brutal Malthusian checks being brought to bear on the lives of impoverished peasants in southern Wales.³⁹

It is a plausible idea. There is also evidence, however, that Wallace had been using Malthusian concepts two years earlier, while pondering population problems in Sarawak. He'd wondered why Dyak village populations remained so small and static when the usual checks to fertility seemed absent: there was abundant good food and a healthy climate, which ought to have been conducive to a rapid increase. He'd concluded that the unceasing hard labour of Dyak women in the fields and mountains must damage their natural fertility.⁴⁰ Malthus was already much on his mind.

It's also possible that Wallace's flash of Malthusian illumination was triggered by his malaria. Anyone who has had recurring malaria

will know the morbidity of its moods. When struck with the disease five years earlier on his return voyage from the Amazon, Wallace believed for a time that he was about to die, like his brother Edward. As well as experiencing grief, Wallace probably also felt an element of guilt. After all, he had accepted responsibility for his rather hopeless brother when he came out to the Amazon and had then left him to make his own way home. Perhaps, in Gilolo, Wallace began to wonder why he himself had previously survived the disease while Edward had not. In trying to answer that vital question – ‘why do some die and some live?’ – he’d turned to Malthus and then realised that the explanation held true for animals even more than for men. He had been better fitted for survival than his hapless younger brother.

Whatever it was that triggered Wallace to think about Malthus, it had given him the key to the mechanism that drove evolution. He was not to know that Malthus had done exactly the same for Charles Darwin in 1837–38, when Darwin reread *Principle of Population* after returning from his *Beagle* voyage. ‘The more I thought it over,’ Wallace recalled, ‘the more I became convinced that I had at length found the long-sought-for law of nature that solved the problem of the origin of species.’⁴¹ He had found the motor that explained how varieties were driven to become new species, in competition with the parent species that had originally produced them.

As he lay in his bed, Wallace tested the idea of Malthusian population checks against the known weaknesses of the evolutionary explanations offered by *Vestiges* and by Lamarck. Neither had a credible, natural, evidence-based explanation for the imperatives that killed off some species and brought new ones into being. *Vestiges* postulated a type of mysterious, inherent principle of progressive development, and Lamarck suggested that animals could will changes and transmit them to their offspring. Wallace decided that the idea of a Malthusian struggle for existence both supplemented and superseded their speculations.

Hanging onto his insight through the haze of his fever, he managed to scribble notes when his malaria fit subsided, drafting a fuller version over the next few days. He then returned to Ternate to put the final polish on the draft and send it to England.

The paper, entitled 'On the Tendency of Varieties to Depart Indefinitely from the Original Type', was vintage Wallace – clear, direct and forceful. Its object, he said, was simple: 'to show that there is a general principle in nature which will cause many varieties to survive the parent species and to give rise to successive variations further and further from the parent type'.⁴² He opened with a blunt declaration that 'the life of wild animals is a struggle for existence'. All their energies were directed to keeping themselves and their offspring alive. The ability to obtain food and escape predators was what caused some species to be abundant and others, though allied to them, to be rare. Nevertheless any animal, if its population remained unchecked, would increase at a geometric pace. It was only because massive numbers of offspring died every year that a species did not engulf the globe. Those that died were the weak and diseased, those that survived the most vigorous and healthy.

It was an 'undisputed fact', Wallace wrote, that all animals produced small variations among their offspring. He, like his contemporaries, knew nothing of genetics in order to explain this fact, but he did know that 'most or perhaps all the variations from the typical form must have some definite effect, however slight, on the habits and capacities of the individuals'.⁴³ Some variations – like a slight colour change for camouflage, or stronger legs for speed – would be advantageous for survival. Useless or disadvantageous variations, on the other hand, would be wiped out. And if a substantial natural change in environmental conditions took place, such as a prolonged drought, an advantaged new variety would inevitably prevail over its parent type.

These parent populations of animals, being in competition,

would decline in numbers or become extinct. Given that the scale of nature was so vast and its time-spans so massive, favourable variations would establish themselves until challenged by new varieties and/or fresh changes of conditions. Domestic species, however, having been selected arbitrarily rather than by a law of struggle, would either perish in the wild or return to the parent type. 'Our quickly fattening pigs, short-legged sheep, pouter pigeons and poodle dogs could never have come into existence in a state of nature.'⁴⁴

Conversely, Lamarck's claim that an animal could use its will to generate useful and inheritable changes was both wrong and unnecessary. Nature, by throwing up chance useful variations, such as a gradually elongated neck on a giraffe, would give it an advantage in feeding and so eventually evolve a new species.

Wallace's concluding paragraph pointed to the massive implications of his deceptively simple argument: 'This progression by minute steps, in various directions but always checked and balanced by the necessary conditions, subject to which alone existence can be preserved, may . . . be followed out so as to agree with all phenomena presented by organized beings, their extinction and succession in past ages, and all the extraordinary modifications of form, instinct and habits which they exhibit.'⁴⁵ He was offering a holistic law that explained the origins and development of all organic beings over deep time – their extinctions, survival, changes of form and behaviour, their distribution across the globe.

For someone as light on for scientific patrons as Wallace, there was one obvious person to whom he should send his new hypothesis. Charles Darwin, with whom he was in kindly correspondence, had been working on this question for some twenty years – he would surely be interested?

Some time in late September 1857, Wallace had sent Darwin a letter asking whether he intended to discuss the origins of humans in his book. Darwin had replied promptly, on 22 December 1857,

saying, 'I think I shall avoid the whole subject [of human evolution], as so surrounded with prejudices.' However, he looked forward to reading Wallace's paper on the Aru Islands with 'the utmost interest; for I think that [is] the most interesting quarter of the whole globe in respect to distribution'.⁴⁶ He also consoled Wallace about the apparent neglect of his Sarawak Law paper by telling him that Sir Charles Lyell had been impressed by his arguments.⁴⁷

What could be more natural, then, than for Wallace to send his new paper to Charles Darwin by return of mail. An accompanying letter expressed the hope that it would supply 'the missing factor to explain the origin of species' they'd both been looking for. He further asked Darwin to show the paper – 'if he thought it sufficiently important' – to Sir Charles Lyell.⁴⁸

Alfred Wallace posted his paper and letter to Charles Darwin through the Ternate mail steamer service on 9 March 1858.⁴⁹



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