

idiosyncrasies and complexities soon became apparent. William Zachariasen discovered that plutonium had six different crystal structures, or allotropes, which he labelled α , β , γ , δ , δ' and ϵ . One of these allotropes had to be formed into a metal suitable for a bomb, which meant being stable and free of isotopes that would interfere with a chain reaction. The metallurgist Cyril Stanley Smith had the good fortune and acute intuition (there were no data) to select gallium to form an alloy with the δ allotrope of plutonium to produce the needed stability.

It was still unclear whether the δ allotrope would revert to the α allotrope before explosion. And a way of bringing the two subcritical pieces of plutonium together to form the critical mass — and initiate the chain reaction that would lead to a nuclear explosion — had to be developed from scratch, as the gun trigger used for the uranium bomb that was dropped on Hiroshima was not suitable. Plutonium, then, presented challenges at every turn. As Bernstein suggests, it may have been only the fear of what the Germans were doing that kept

the physicists working long into the night.

This book will make demands of readers. There are many things to hold in the mind as Bernstein repeatedly moves away from the main thrust of the book to develop one of these side stories, which enrich the story of plutonium but are also sometimes a distraction. But Bernstein's writing ability smooths the way and makes this a successful book. ■

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Trouble in paradise

Coral: A Pessimist in Paradise

by Steve Jones

Little, Brown: 2007. 256 pp. £15.99

Daniel Pauly

If I had first seen *Coral* by Steve Jones in a bookshop, rather than receiving a review copy, I would have bought it. I would have been attracted by its superb cover, whose eerie blue serves as a glorious background for a swimming red snapper. And attempting to casually browse through the text, I would have been slowly ensnared by the loops of its fascinating literary, historic and scientific digressions.

Any book with the word 'pessimist' in its title must have a sound basis. Here it rests on Charles Darwin's solid shoulders — or more precisely, on his first scientific book, from 1842, *The Structure and Distribution of Coral Reefs*, in which he presented a hypothesis that solved the riddle of how coral reefs grow, where they grow, and why. Jones, in his first chapter, explains how Darwin came to his hypothesis, how it shaped all subsequent research on coral reefs, and how drilling into Pacific atolls, conducted in support of nuclear bomb tests, ultimately confirmed it.

Darwin's book

relied on the simple but profound idea that 'lowly' organisms, here coral polyps, pursuing their own tiny goals, through their sheer numbers and over the immensity of time, could play major roles on the geological stage. This is also a theme in his 1859 book *The Origin of Species*, whose detractors could not fathom the transformative power of small, between-generation changes occurring over eons. This simple idea was again the theme of his 1881 book on the slow, subterranean work of earthworms, *The Formation of Vegetable Mould Through the Action of Worms*, to which he devoted his final years.

Genomics has given us a powerful tool to study the phylogenetic history and affinities of these tiny agents of change. In his second chapter, Jones uses genomics and the hydra (a non-colonial polyp related to corals) to introduce the notion that the cells of hydra cooperate, just like those of people.

They do this, says Jones, because they have learnt from the mutually beneficial relationships of

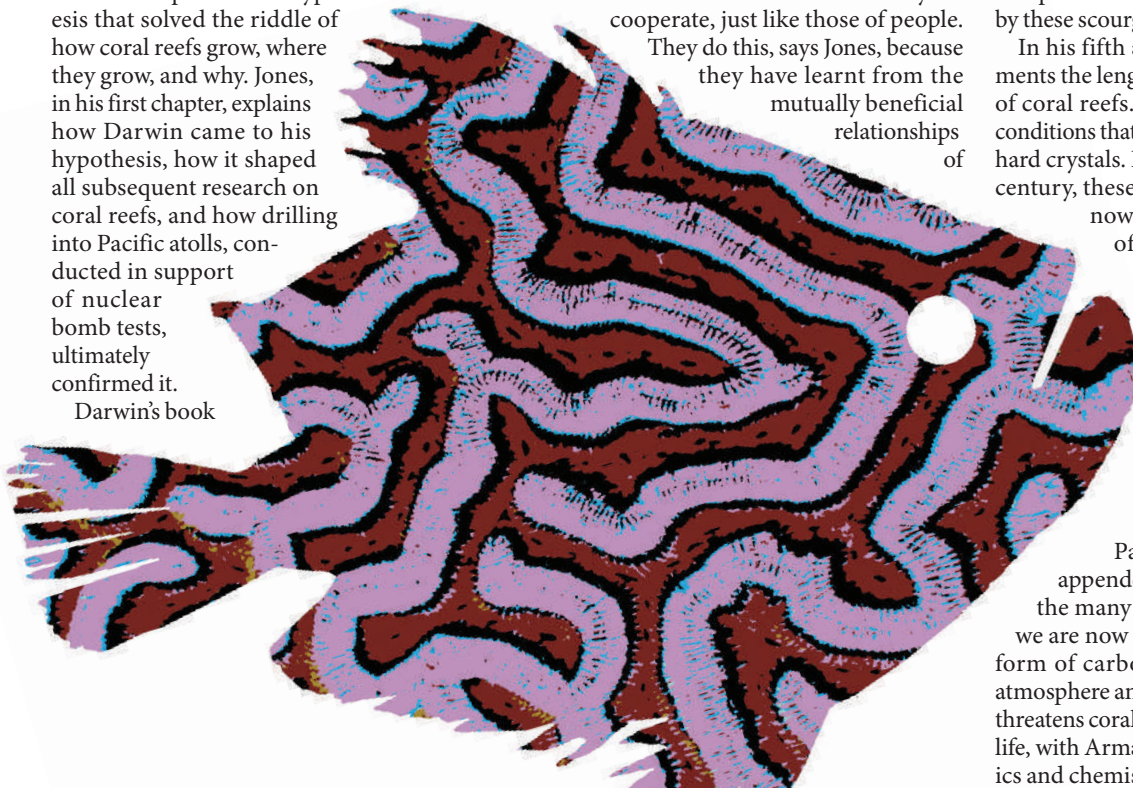
their organelles, many of which are descendants of formerly independent bacteria-like organisms.

He explores this idea further in the third chapter, which is devoted to what appears, in coral reefs and other ecosystems elsewhere, to be disinterested cooperation between species. But it isn't, notwithstanding the benevolent anarchist Prince Kropotkin, who gets a loop of several pages. Rather, barely masked warfare prevails, interrupted by tenuous and short truces, revoked when conditions change. Altruism seems to be limited to humans, and one of the biggest tasks we face is to expand our altruistic acts from our circle of relatives, friends and compatriots to the whole of humanity.

Jones then disposes, in his fourth chapter, of the tenacious Western myth of South Pacific coral islands as 'paradise'. Life was too precarious for that, particularly after the first contact with Europeans, who brought previously unknown diseases, some sexually transmitted. The abolition of cannibalism did not compensate for the population losses caused by these scourges.

In his fifth and final chapter, Jones documents the lengthy and rapacious exploitation of coral reefs. He starts with the geological conditions that cause carbon to form extremely hard crystals. In the middle of the nineteenth century, these conditions in parts of what is now India enabled the Maharajah of Hyderabad and his court to trade diamonds, via the East India Company, for jewellery carved from calcium carbonate from Mediterranean corals. Now the East India Company is no more, and these precious corals are mostly gone too.

Jones calls the book's epilogue, entitled 'A Pessimist in Paradise', an 'envoi', as if it were appended to a poem. He uses it to pull the many strands of this book into one: we are now stuck with trash carbon in the form of carbon dioxide that gums up our atmosphere and, as carbonic acid in sea water, threatens coral reefs, and indeed much marine life, with Armageddon. He explains the physics and chemistry involved with much verve,



and more looping (Captain Cook, Australian cockatoos, the Permian extinction, the prospect of 9 billion humans, the Irish Republican Army, California's abalone, Newton, Funafuti Atoll in Tuvalu...).

Finally, he explains his pessimism: "The world of coral gives more reason for despondency than for hope. Local conservation can do

little in the face of global change. The future of the reefs is bleak indeed. Their end presages a catastrophe that will spread far beyond their bounds — and remind us that we too are far from safe."

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argue, the mere existence of tools does not prove that hunting was important, much less that it was the mainstay of hominin survival or a predominantly male activity.

Such biases of the prehistoric record are common, especially with regard to the oldest sites. The authors aver that in recent dry cave sites, fibre artefacts outnumber stone ones by a factor of 20 to 1. In several other situations, fibre and wood artefacts have been found to account for 95% of all artefacts recovered. That amounts to a tremendous amount of information not available to archaeologists in most parts of the world.

These are stunning observations that remind anthropologists that what we see is a tiny fraction of what might once have been present, not only in terms of individual animals but also in terms of artefacts. Many of those 'lost' artefacts may be essential aids to gathering, capturing small (not heroically large) animals, or modifying the world (building nests or brush shelters) in ways that do not involve obtaining food.

The authors also review the fascinating discovery by Adovasio and Soffer of fibre impressions on the clay fragments at Dolni Vestonice I in the Czech Republic. These attest to the existence of eight different weaving techniques, sewing, net-making and basketry, providing a startling new glimpse of life 26,000 years ago. They suggest that fibre arts had been a well-developed industry for some time before the formation of that site.

Making things out of fibre is not the sole prerogative of either sex in ethnographic accounts, the authors point out. But throughout the tribal world today, women make most of the basketry. The making of ceramics items, especially pottery, is chiefly the province of women. So, they claim, it is safe to assume that most, if not all, of the ceramics, weaving, basketry and clothing was made by women in the years that Dolni Vestonice and the other Moravian sites were inhabited.

This is an astonishing leap of faith for those who have advocated a greater appreciation for the variability and malleability of gender roles elsewhere in the book.

The interpretations offered by the authors are no more convincing than the standard

ones, primarily because their interpretations are based on ethnographic and behavioural analogies that are different from, but not demonstrably sounder than, those they criticize.

Unfortunately, they never grapple with the central and most difficult questions of all. For example, when is it justifiable to draw on behavioural analogies from modern humans to interpret the past? When ought we to rely on behaviours of non-human primates or other mammals instead? And how are we to evaluate

Unearthing gender issues

The Invisible Sex: Uncovering The True Roles Of Woman In Prehistory

by J. M. Adovasio, Olga Soffer & Jake Page
HarperCollins: 2007. 320 pp. \$26.95

Pat Shipman

The Invisible Sex is a refreshing book that opens with a crucial reminder: "science is not truth; it is, instead, a method for diminishing ignorance." The authors — two well-known anthropologists (Jim Adovasio and Olga Soffer) and a science writer (Jake Page) — set out to diminish readers' ignorance about the human past, using a breezy, colloquial style that only occasionally irritates.

Their main point is that the male-dominated science of anthropology has usually chosen to interpret the evidence of the human past by basing it on male-dominated stereotypes. The authors succeed admirably in heightening the readers' awareness of such practices and in countering these stereotypical presentations with imaginative and equally defensible re-interpretations of particular sites or bodies of evidence. The end result helps to flesh out a more plausible female role in prehistory than has been offered previously. In many ways, this book is a much-needed antidote to the past hundred years of popular and scientific writing on prehistoric human life, and avoids the clichéd pitfall of veering too far into a hyper-feminist view.

The authors make many palpable hits. For example, they remark on the assumption that Lucy, the first largely complete *Australopithecus* to be found, was identified as female because the bones were small, not because they were diagnostically female. Similarly, they deconstruct the beautiful diorama at the American Museum of Natural History in New York of two australopithecines walking across the Laetoli plains, which are covered in damp volcanic ash, about 3.3 million years ago. A male and female walk together companionably, his arm around her shoulders. The female's head is turned,

giving the impression that she is looking at the viewer, while the male remains focused on what lies ahead. The subtext of this depiction emphasizes the intimacy of their closely spaced footprints with the familiarly possessive/romantic gesture of a male arm around the female's shoulders. What would fit the evidence just as well — and echo many more observations of primate social behaviour — would be that the footprints were made not by a 'couple', but by a female and her juvenile offspring. Why choose one over the other?

Another target for scepticism is the supposed dominance of a hunting lifestyle among hominins. This idea ranged from Raymond Dart's lurid osteodontokeratic hypothesis — that bones, teeth and horns were used with minimal alteration by early hominins as tools for slaughtering animals and possibly each other — through the presentation of early, tool-making *Homo ergaster* in East Africa as a hunter rather than a scavenger. This 'man the hunter' stereotype lingers in images of the mighty, mammoth-slaughtering Palaeo-Indians in North America. And yet, the authors

