

Book Reviews / Critique

William A. S. Sarjeant, *Quarry. Closing in on the Missing Link*
by Noel T. Boaz / 98

William A. S. Sarjeant, *To a Rocky Moon. A Geologist's History of Lunar Exploration*
by Don E. Wilhelms / 99

William A. S. Sarjeant, *Mining in the Americas. Stories and History*
by Helmut Waszkis / 100

William A. S. Sarjeant, *Quest for African Dinosaurs. Ancient Roots of the Modern World*
by Louis Jacobs / 102

Jean-Marie M. Dubois, *Ice Age Earth: Late Quaternary Geology and Climate*
Alastair G. Dawson / 103

W. A. S. Sarjeant, *Dougal Dixon's Dinosaurs*
by Dougal Dixon / 104

Book Reviews

Quarry. Closing in on the Missing Link

By Noel T. Boaz
Free Press, New York;
Maxwell Macmillan, Toronto
 226 p., 1993, US \$22.95

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Most fields of the earth sciences have, at times, turned briefly into battlegrounds, but it is doubtful whether any has been so nearly the scene of ceaseless combat as paleoanthropology. When *The Origin of Species* appeared late in 1859, Charles Darwin's single closing reference to man's evolution, indirect and oblique though it was, attracted more attention than any of his earlier and more extended considerations of the evidence for his theory. From then onward, it has been a matter of fierce debate, in which the consideration of evidence has been much too often done through the blinker of preconception, and concepts have been too often formulated by prejudice rather than by mature scientific consideration.

In this field, it seems, nothing is agreed upon immediately and very little secures lasting endorsement. The generic and specific names of taxa — indeed, the very concepts of how genera and species names should be formulated — have varied so drastically that even the reading of contemporary texts can be highly confusing. Each paleoanthropologist plots primate lineages differently and derides the lineages favoured by others. Stratigraphical correlation has been a focus for especially bitter dispute, and even the matter of the absolute dating of specimens by radioactivity has generated

acrimony.

For more than 20 years, Dr. Noel Boaz has been a vigorous participant in many of the major conflicts. He states frankly that: "I am always sceptical of ideas in science that have been accepted uncritically for a long time" (p. 217). In another context, he reports equally frankly that: "I admit that I gave short shrift to the ideas of my colleagues" (p. 193). As a consequence of his disagreements with Richard Leakey, he notes amusedly that he was called the "mad dog of Berkeley" (p. 71) and that, when he began the study of coprolites, irreverent colleagues were gaining applause by reporting that "Boaz's work is really shit" (p. 221).

Predictably, then, this is a lively book in which Dr. Boaz's personal participation in many scientific skirmishes and battles is recounted with great relish. He gives blow-by-blow accounts of battle with such elsewhere-revered figures in the study of human evolution as the Leakeys, Tim White, and Donald Johanson. Yes, Dr. Boaz is capable of admitting his own possible errors, as in "The Flipperpithecus affair" (p. 127-129) where a bone supposed by him to be a human clavicle seems likelier to have been a dolphin's rib, but he is too much of a battler to make such admissions often.

Some of his characterizations are effective, as when he talks of the "Indiana Jones School of Paleoanthropology," focussed wholly upon the finding of primate remains and ignoring the associated fossils and paleoecological context (p. 133), or of the "streetlight effect", whereby fossil primates are sought in readily accessible, well-trodden regions of the globe rather than in the places where they are likeliest to be found (p. 237-239). His own extensive fieldwork, not only in lands that are relatively safe in political terms (Kenya, Tanzania), but also in lands that are not

(Libya, Ethiopia, Zaire), shows that he is personally prepared to risk searching in the gloom beyond those geological streetlights.

Many of his ideas merit respectful consideration. Examples are his discussions of the effectiveness of gorilla locomotion on steep slopes (p. 151) and of the relation of bipedalism to speed (p. 138-139, although, in the latter regard, he seems unaware that such reptiles as the whiptail lizards of the southern United States adopt a bipedal gait when travelling fastest). Some of his arguments are not well presented: he proposes, only as a scenario, that *Kenyapithecus* became extinct through forest dwindling in the Late Miocene, but then uses this as a fact in the ensuing discussion (p. 155). The assumptions from genetics, which he uses on page 231, strike this reader as especially dubious; could not the temporary isolation of a small group, rather than the extreme reduction of a population, equally well allow a chromosomal rearrangement?

There are some unnecessary repetitions of information given on earlier pages (p. 210 and p. 226), and there is perhaps too little illustration: only four plates and three text-figures. However, the editing and proofreading were otherwise commendable.

A lively work, then, and well worth reading as a window upon this vigorous world where scientific advances are made amid unceasing controversy. It will be interesting to see how Dr. Boaz's colleagues respond to his opinions, as here expressed: with equal vigour, I do not doubt!

To a Rocky Moon. A Geologist's History of Lunar Exploration

By Don E. Wilhelms
University of Arizona Press, Tucson
477 p., 1993, \$29.95

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Writings about voyages to the moon began with Lucian, almost 1 900 years ago, but these early works were all mere fantasies, parodies or allegories. Not until 1638 was a serious and reasoned case presented for a voyage to the moon, by Bishop John Wilkins — almost my ancestor — in his *Discovery of a New World*. (Wilkins was the first husband of my ancestress, Richard Cromwell's daughter and Oliver's granddaughter; her second husband John Tillotson, later Archbishop of Canterbury, was my own forebear.) From then onward, there have been very many works visualizing voyages to the moon, some scientific, some fantastic, and many in which fantasy and science are commingled in varying measure.

The crucial figure in such works is most often a lonely scientist who has built, single-handedly or aided by dedicated assistants, some mechanical device that will enable a voyage into space. This has been done in secrecy (and, one imagines, at surprisingly moderate cost), in an understandable desire to avoid media attention. Usually the hero or heroine is not that scientist, but some other person who has become involved in the voyage willingly, as in H.G. Well's *The First Men in the Moon* (1900), or extremely unwillingly, as when his charlady, while dusting, accidentally activates the nylon rocket constructed by Dr. Strabismus (*Whom God Preserve*) of Utrecht and is whisked to the moon willy-nilly (Morton, 1959). To my knowledge, the only case in fiction where a committee successfully constructed such a device was when the Gun Club of Baltimore, Maryland (as imagined by Jules Verne) built a giant cannon and successfully fired at the moon a manned bullet!

If he was aware of these fictional precedents, Dr. Don Wilhelms, the author of this work, must have sighed enviously

at the simplicity of those inventors' activities. In particular, he must have envied their freedom from the constraints of committees (even the Gun Club members were unanimous in their desires), but those persons involved in planning the United States moon shots certainly were not unanimous, and those committees were multifarious, with an ever-varying personnel. So numerous indeed were they that the list of their, and other, acronyms exceeds a page (although one most commonly cited, JPL, is not included). Many other pages of this carefully written history report fluctuations in titles and responsibilities, confrontations, and the prolonged arguments preceding any making of decisions. All too often, those disputes over the moon flights were based upon false preconceptions rather than evidence, but then, as Dr. Wilhelms notes wryly: "...no amount of data can shake a theoretician deeply committed to his ideas." (p. 92)

Another major element of this story is the impatience with which scientific study of the moon was so long regarded by politicians, military men, and engineers. For geologists, its particular hero must be Dr. Eugene Shoemaker, who laboured long in persuading all those committeemen — there were no women involved — that the astronauts should at least be instructed in the identification of rock types and the recognition of volcanic or impact structures. (His nickname, "Super Gene" (p. 57), was well merited.) Only on the very last Apollo flight was a geologist, Jack Schmitt, included in the crew; the quality of his observations so much surpassed those made earlier that one can only regret that no other geologists had been included.

In the course of this history, Dr. Wilhelms makes many revealing comments. For example, he notes that the United States Geological Survey (USGS) was anathema not only to the National Aeronautics and Space Administration (NASA)

...but in much of academia, presumably because the USGS was a little too aware of its leadership in American geology. This feeling has a long history. I quote the following letter, dated May 1906, to D.M. Barringer from J.C. Branner, who had recently resigned from the Survey: "Survey people have a way of knowing it all that is quite convincing to themselves and to a

large part of the rest of the world. That you dare to call into question the conclusions of a member of the Survey will be looked upon with suspicion and strong disapproval you may be sure. (p.233)

Nor, when he feels it proper to be frank, does Dr. Wilhelms pull his punches. Referring to Anthony J. Calio, Director of the Science and Applications Directorate of the Manned Spacecraft Center, he notes that:

Calio's name still raises the hackles of the USGS survivors of that era, and I suspect the feeling is mutual...Calio and his directorate were constant thorns into sides of...the entire USGS operation. (p. 237-238)

Concerning Paul Gast, Calio's chief science advisor, Dr. Wilhelm is even more forthright:

Many geologists (including me) found Gast obnoxious, but he was straightforward (often a positive aspect of obnoxiousness) and an effective manipulator who could get things done. (p. 238)

Dr. Wilhelms is even forthright about himself, freely confessing his errors, as when his "general impatience with lecturers" caused him to miss an important talk (p. 130), or when the ignoring of his recommendations proved beneficial. Only on one occasion does he hold back:

A USGS astro-geologist who should have known better (and who is not named anywhere in this book) interpreted the long shadows cast by boulders under low Sun illumination as shadows of spires, and this blunder was picked up by the sensationalist press and various nuts as evidence of missiles emplaced on the Moon. A UCLA astronomy student pestered me for an entire year afterward in an effort to get me to admit that we were covering up a military secret. (p. 158)

All in all, this is a meticulously researched and presented study which, if only occasionally makes for exhilarating reading, is always lucid. Textual infelicities do occur (I winced at "plenty of unique opportunities," p. 289), but they are rare, while the few mistakes I noticed — notably the misspellings of the first names of Piero Leonardi (p. 102) and Kurt von Bülow (p. 129) — may be dismissed as undetected printer's errors. The worst error was the failure to include maps of the moon: the many names of craters, rills and mares were

no doubt familiar to the author, but there is nothing to help the reader discover how they were related in position to each other. That is the only major fault in a work surely destined to become a standard reference work on this brief episode in the history of science. For brief it was to prove; the whole exploration of the moon by the United States spanned only eight-and-a-half years.

The trouble was that, although thrilling for geologists, the moon proved a sad disappointment to the general public. They had not anticipated a giant "man in the moon" surviving from a time when the moon severed from Earth, such as was encountered by Hugh Lofting's Dr. John Dolittle; certainly they had not expected a whole colony of surviving early human settlers, as in Bohun Lynch's neglected, haunting vision of an Earth-moon confrontation; nor did they truly expect anything like H.G. Wells' mooncalves or Edgar Rice Burroughs' turbulent subterranean lunar world. However, they *had* expected the moon to be an interesting place, offering economic riches that might justify a permanent human settlement. Instead, it had proved a bleak world of subdued colour, without discernible economic attractions, and quite incapable of sustaining human life.

From the outset, as Dr. Wilhelms admits, there had been criticism of the whole space exploration project as "...a waste of money, which [critics] felt should be spent on more noble causes of their own choosing than on a welfare program for white male engineers." (p. 50) To make matters worse, as he notes:

Americans traditionally have believed that everything must serve some practical purpose, and engineer-dominated NASA did not allow Apollo to stand on its own merits. They talked of spin-offs like the famous Teflon frying pans, electronic miniaturizations, and military capability that could grow from the space program, but seldom of a bold and exhilarating adventure on a new frontier or of a scientific probe into the unknown. Except for a few highlights like Apollos 8, 11, and 13, NASA and the news media succeeded in the seemingly impossible task of making a flight to the Moon seem boring; this despite the spectacular scenery and colour television during the J missions.

Americans have notoriously short memories and attention spans. Engineers similarly say, "If it works, it's

obsolete." NASA built the greatest rockets and spacecraft in history and then scrapped them. NASA could not get Americans to the Moon today or five years from today. It gathered immense amounts of data and then literally threw them in the dumpster. (p. 336)

However, geologists learned much about the moon during those few years: in particular, that its history was wholly different from that of our own planet, and its topography the product, not of volcanic activity as had been supposed, but of impact only. Dr. Wilhelms recounts the evolving concepts lucidly and fully, discussing the ideas that were to be jettisoned, as well as those that have held up to scientific scrutiny.

His summation is admirable and merits quotation:

Possibly the most important spin-off from Apollo is the concept of Space-ship Earth. Apollo may have been a first step into the cosmos, but further steps have not yet followed as we thought they would. Apollo taught that we *cannot* colonize space except on a very small scale. The astronauts had to bring absolutely everything with them to sustain their lives, and at the present rate the Earth will be worn out long before the knowledge to live cost-effectively on the Moon or another planet is developed. Earth is our home. (p. 355-356)

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Mining in the Americas. Stories and History.

By Helmut Waszkis
 Cambridge, England
 Woodhead Publishing Co.
 280 p., 1993

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To attempt an overall history of mining in the Americas is a courageous endeavour, and to compress that history within 300 printed pages is a considerable feat. Helmut Waszkis has unusually good qualifications for such a task. He has worked in the mining industry in the United States, Canada, Peru and Brazil, as well as in Germany, Turkey and India. He has travelled in Mexico, Colombia, Bolivia, Argentina and the Caribbean, and, as will be apparent from the sources he quotes, he is able to read and speak a variety of languages (certainly German, Spanish and English, probably also Portuguese).

This book is the product not only of knowledge of the mining industry and a profound interest in its history, but also of a laudable ability to digest and condense the information gained by a wide reading of the literature of mining and exploration. Some of the works he cites are well known to mining historians, but very many are not.

For us Canadians, the section on the history of mining in our country will inevitably prove disappointing. The themes treated are dealt with well enough — the summary of the Klondike gold rush is especially lucid — but whole areas are dealt with either in passing (e.g., uranium mining) or not at all (e.g., the Saskatchewan potash industry and the Alberta oil shales). The section on the United States is better, but only somewhat less brief. It makes intriguing mention (p. 224) of a possible gold discovery on Manhattan Island, and gives brief treatments of some major mining regions (California, Nevada, Montana and the molybdenum mines of Colorado), but it leaves many other discoveries unconsidered, including those in Arizona and Alaska.

The great value of this work is in the historical surveys it provides of mining in Mexico and the various countries of

Central and South America, information not readily gained from any other source and deeply interesting to any historians whose horizons extend beyond the boundaries of their own country, and of interest also to the current crop of explorationists. Particularly useful are the lucid treatments of the history of mining in Peru, Bolivia, Chile and Brazil, and the compilation of information concerning discoveries of ore in countries not noted for their mineral wealth: the major Caribbean island realms, the countries of mainland Central America, Paraguay and Uruguay. Chapters on animal and railroad transport of ores give proper stress to their importance in the history of mineral exploitation. A final chapter, assessing the significance of mining to New World history in general, is calculatedly controversial.

When so broad a canvas is being painted, there are bound to be errors. The brief prehistory of the finding of metals (Chapter 1) includes no mention of early discoveries of iron, yet meteoritic iron, at least, was surely found early on by primitive man. Cinnabar is scarcely to be described as "orange-coloured" (p. 77): rather, it is deep red in hue. The Brazilian word *garimpeiro*, first used on page 184, is explained only in an illustration caption on page 188. "Equador" (p. 53 and elsewhere) is an unfamiliar spelling of the name of that country, and "excellency" is used several times (e.g., on p. 74) when "excellence" is meant. There are also rather too many undetected typographical errors: "Pureto Rico" (p. 19), "scatterd" (p. 54), "or course" when 'of' is meant (p. 63), and "dimished" (p. 144).

The placement of notes at the ends of each chapter is an excellent feature of this book; these amplify, and in some cases justify, the comments in the main text. In the extensive "Bibliography," however, I would personally have preferred that paginations were cited; their absence will cause this reader, at least, much work.

English is not the author's first language. Surely as a consequence, he has favoured short, simple sentences and has avoided the use of similes and metaphors. The product is a text that is generally lucid and easy to understand. Personally, I deprecate the beginning of sentences, and even paragraphs (e.g., on p. 177), with such conjunctions as "And..." or "But...". However, since a great many authors adopt that practice

nowadays, Mr. Waszkis can scarcely be held blameworthy for following their bad example!

His account contains much that is fascinating, and quite a lot that is sheerly horrific, for the governance and management of mining (and, in particular, the treatment of the indigenous peoples of the Americas) has very often been appalling. In the former category is the story of how a company engineer named Cassio, sentenced to death by miners working illegally in Brazil, talked amiably with them *for more than 15 hours* before they freed him, in the process gaining their lasting respect (p. 189-190). The latter category includes an account of the mistreatment of the natives forced to work the Santa Barbara mercury mines in Peru:

They were ordered to go underground, and most of them simply stayed and died there. Food was taken down. They laboured in near obscurity, day-in, day-out, always exposed to and swallowing the dust and the slight mercury fumes. Rules that there should be days of rest were ignored; the concession holders were only interested in getting the maximum quantity of ore out of the mine. The natives worked with very primitive tools and simply followed the colour of the veins, digging ever deeper into the mountain...

As time went on, Santa Barbara became known as "the mine of death." It was not the slave labour system of working permanently underground that gave it this reputation; it was not even the occasional cave-ins, not even the big ones following earthquakes. It was rather that whoever went underground and stayed there for some time inhaled too much mercury-bearing dust and became incurably ill. The natives of central Peru came to dread having to go to Santa Barbara. (p. 79)

Equally appalling is the description of the uncontrolled exploitation of the Serra Pelada gold mine in Brazil and of the miners' shanty-town, understandably named by them "Babylonia":

It was just a filthy dump. It was — said those who saw it then — like the worst kind of slum in Rio de Janeiro. Housing was just ramshackle — huts, lean-tos, tents, tarps and plastic sheets hung like tents. There were very few constructions that could have been called buildings. There was, after all, no way to get anything to the place except by plane or by foot. So housing

consisted of what people could carry in, and what they could make with what they found there, tree trunks and branches, leaves, and so on. And they had not been able to dig holes, or had not wanted to, because it was always raining, and what good is a hole in the ground as a home when water collects in it?...

There was garbage all over. People urinated and defecated wherever they pleased. There was no sanitation, no public toilets. When the numbers had been few, toilets appeared unnecessary. But with thousands...? (p. 194)

The callousness shown to the natives was indeed equalled, or surpassed, by the callousness shown to one another by the miners themselves, in their greed for riches. (Perhaps the love of money is *not* the root of all evil, but beyond doubt, it is one of the principal roots.) Yet, it remains appalling, as the author freely admits (p. 254), that so few of the original peoples survived the European expansion into the Americas. How many died, in the early centuries of settlement: 30 million men, women and children? 100 million, maybe? We can never know now.

Mr. Waszkis has been employed principally, perhaps exclusively, by mining companies. His opinion that "Governments have no business to operate mines or smelters" (p. 253) will not be endorsed by all his readers, nor will his view that foreign capital should be welcomed everywhere (p. 257 and elsewhere). Although he does demonstrate how considerably foreign capital has contributed to mining development in most American countries — the United States is arguably an exception — one is left wondering whether those countries might have had a happier history if their resources had remained undeveloped. Whatever one's views on such matters, one will learn much by reading this very useful and interesting history.

Quest for African Dinosaurs. Ancient Roots of the Modern World.

By Louis Jacobs
New York: Villard Books
314 p., 1993, \$24.50

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My colleague, Robin Renaut, is a regular visitor to Malawi in connection with his work on lake sediments, especially evaporites. Upon first learning this, I asked him why the name of Malawi's principal lake, Lake Nyasa, had been changed when the country gained independence from Britain. His answer was that the old name had made no sense: since "nyasa" meant "lake," it had been called "Lake Lake"!

That misunderstanding epitomizes the way in which Europeans have for so long failed in their comprehension of indigenous peoples, especially in Africa, while the Malawians' ready acceptance of such absurdities well expresses their own gentle acceptance of the obtuseness of others.

Dr. Jacobs clearly loves and respects the Malawians for their exceptional tolerance and kindness (their hospitality to the overwhelming numbers of refugees from war-torn Mozambique is a lesson to all humanity.) Their excitement concerning the discoveries of dinosaurs made by Jacobs' team matches the excited response similar discoveries have evoked in Europe or North America. Moreover, it is salutary to be made aware that the scientific treasure-trove of fossils and artifacts is valued higher, and better protected in Malawi — a poor, definitely Third World country — than in the majority of Canadian provinces and American states.

Most paleontologists, when challenged by the title *African Dinosaurs*, will think immediately of Tanzania: of Tendaguru, where dinosaur fossils were discovered by German scientists before the First World War and subsequently collected during several British expeditions. The discoveries at Tendaguru (misspelled "Tendagura" in the index, p. 313) are given adequate mention, for Dr. Jacobs hoped at one time to work there; indeed, he began his Afri-

can researches in neighbouring Kenya. However, bureaucratic problems and financial vicissitudes made that project impossible and chance took him to Malawi instead. It is with his work in that country that this book is especially concerned, although his expeditions to Cameroon, in west Africa, are also described.

This is by no means a mere account of Dr. Jacobs' field expeditions and their results, nor does he limit himself to explaining the international context of his discoveries. Indeed, the digressions from this theme are numerous and sometimes, to this reader, very interesting, as in the case of Dr. Jacobs' description of the behaviour of hagfishes and slime hags (p. 222-225) and his very cogent criticisms of the blinkered perceptions of the fundamentalists (p. 260-261).

I was impressed also by the excellence, relevance and sheer entertainment value of the many figures; the artist, Mary Ann Zapalac, merited a more conspicuous credit than the mere mention she receives at the end of the preface (p. xiii). The clear maps and sections; the many lively "action pictures" of dinosaurs; the well-planned and well-executed drawings to clarify, for example, the significance of the features of the sauropod skeleton; and the vigorous depictions of the human protagonists in Dr. Jacobs' account all deserve high praise.

On the debit side, I was not always happy with Dr. Jacobs' writing style, which ranges erratically between the excellences of good scientific literature and the mannerisms of current campus journalism. Although I strongly disapprove of sentences that begin with conjunctions, I have to recognize that this procedure is coming to be considered acceptable. However, there were other usages that truly caused me to blench: "increasingly more" (p. 24) and "kind of like" (p. 177). Do we need the word "nondinosaur" (p. 62)? How does one differentiate a mere supercontinent from a "super-supercontinent" (p. 48)?

Misusages of commas and sentences without verbs are quite numerous and almost always stylistically unnecessary: "On the bottom of the ocean, or the top of a mountain." (p. 30) The effect is often to give a jerkiness to the text: "Famous *Archaeopteryx*. It has feathers. Only birds have feathers. *Archaeopteryx* is already a bird." (p. 160)

Then there are times when the imagery becomes a little too wild. Diatoms do not really have "beautiful silica bodices" (p. 46); the whole cell is enclosed within the frustule. The River Nile does not truly "debauch" the Mediterranean (p. 244), although that was probably a misprint! My favourite, though, occurs on page 49: "Finally, at 100 million years ago, Brazil cruised away, by continental drift, into the sunset." Quite a day, that must have been!

There are a very few minor errors. Not all *Eucalyptus* trees are blue gums, as page 89 implies. The dinosaur trackways of the Paluxy River in Texas were not "known since early this century" (p. 259), but only as a consequence of Roland Bird's work in the 1940s.

A major error, for me, is Dr. Jacobs' belief in that scientific chimera "The Great Dying" and his preparedness to accept an extraterrestrial cause for that paleontological non-event. Where in the world does that much-touted iridium layer directly overlie bones of dinosaurs or marine reptiles, the shells of ammonites, or the guards of belemnites? Why did this "mass decimation" of the world's fauna and flora fail to inhibit the evolutionary flowering of lizards, snakes, birds, mammals and even crocodiles? Why did it not destroy the phytoplankton of the oceans? (The dinoflagellates, for example, remained quite unaffected by this "cosmic cataclysm.") Why is it that the number and variety of dinosaurs, in the very few regions of the world where latest Cretaceous continental deposits are accessible for study, show a decline over the several million years preceding that much-touted "event," a decline exactly comparable with that shown at other times by many other vertebrate groups, prior to their extinction? No, the only "Great Dying" suffered by the world's animals is not an event of 65 million years ago, but an event of our own time and a consequence of mankind's own actions.

However, despite that difference of opinion and despite recurrent difficulties with Dr. Jacobs' writing style, I enjoyed this book. I recommend it as good, informative reading, not just for students and scientists, but for all persons with enough intellectual curiosity to wish to know more of the world, present and past.

Ice Age Earth: Late Quaternary Geology and Climate

Alastair G. Dawson
Routledge, Chapman and Hall, Inc.
New York
1992, 293 p.

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« Ice Age Earth » est le neuvième volume de la série sur l'environnement physique dirigée par Keith Richards de l'University of Cambridge. L'objectif de la série est de constituer un ensemble de manuels sur la géographie physique et les domaines connexes, chaque volume devant présenter une synthèse notoire.

La personne qui essaie de relever le défi cette fois est Alastair G. Dawson, chargé de cours en science du Quaternaire au Département de géographie de Coventry Polytechnic. Son objectif est de doter les étudiantes et étudiants d'un manuel qui résume bien les apports pluridisciplinaires sur les faits et les théories les plus significatifs pour comprendre les événements et les héritages du Quaternaire tardif, en mettant l'accent sur les changements climatiques. Le manuel ne représente sûrement pas la première synthèse sur ce sujet, tel que l'annonce l'éditeur dans sa publicité, mais il en est certainement une convenable, comme on pourra en juger à l'analyse.

Le manuel se présente d'abord sans prétention. Il est bien édité, bien relié, bien imprimé and bien illustré. Il y a cependant quelques coquilles de typographie et il faut déplorer que le système métrique ne soit pas respecté intégralement. Il possède toute l'information liminaire qui se doit : table des matières exhaustive, liste des planches, des figures et des tableaux placées en début de volume, ainsi qu'un index thématique et des auteurs cités placés en fin de volume. Les références sont abondantes et internationales, mais il est clair que l'auteur n'en a choisi, sauf quelques rares exceptions, que celles qui étaient en anglais, parfois au détriment de la qualité de l'information. Heureusement que l'auteur en est conscient

et avoue même, dans la préface, qu'il a dû omettre des points probablement importants.

Le contenu, lui, est divisé en treize chapitres, dont les premier et dernier forment respectivement une introduction et une conclusion. Sauf l'introduction, ces chapitres sont bien balancés et, tel que précisé par l'auteur lui-même, ils ne semblent pas biaisés dans son domaine de spécialisation particulier. Ces chapitres ont, en moyenne, 21 pages et neuf illustrations. Ils ont tous une introduction et un sommaire relativement bien fait, de sorte qu'il est facile de connaître l'ensemble du contenu rapidement ; ceci présente un niveau de lecture intéressant en terme de pédagogie.

Avant d'entrer dans le détail des chapitres, une précision est importante. Malgré le sous-titre du manuel, qui porte à croire qu'on traitera de tout le Quaternaire tardif, on n'y traite en réalité que de la période entre le Sangamonien (ca. 130 000 ans A.A.) et la fin de l'englacement wisconsinien (ca. 7 000 ans A.A.). Pendant cette période, l'auteur tente de montrer quels sont les plus importants changements géomorphologiques qui sont survenus suite aux changements climatiques planétaires et régionaux (sens de continentaux).

Le manuel commence par un schéma planétaire des variations climatiques depuis le Sangamonien, surtout à partir de l'étude par géochimie isotopique des carottes océaniques et glaciaires. Ce schéma est suivi par les résultats du projet CLIMAP, qui est une simulation par ordinateur des circulations atmosphérique et marine, ainsi que de leur interaction, durant le dernier maximum glaciaire, soit vers 18 000 ans A.A.

Deux chapitres portent sur l'évolution des événements du Sangamonien au déglacement final. On y voit la variabilité régionale de l'histoire glaciaire et la rapidité des changements climatiques. Il est cependant un peu dommage que l'auteur y fasse entièrement confiance aux grandes synthèses, telle celle de Dyke et Prest (1987) pour l'Amérique du Nord, et ne soit pas descendu au niveau des synthèses faites par les chercheurs régionaux (ici sens de grandes régions). Par exemple, pour le nord du golfe du Saint-Laurent, la limite glaciaire de Dyke et Prest (1987) à 12 000 et 11 000 ans A.A. est fautive; il aurait fallu corriger avec celle de Parent *et al.* (1985). Inconsciemment, l'auteur a cer-

tainement pu contribué à perpétuer des erreurs dans d'autres parties du Monde.

Les sept chapitres suivants portent sur les changements géomorphologiques survenus dans les régions non affectées par les glaciers ou en bordure glaciaire. On y voit, par exemple, l'évolution du pergélisol, des plans d'eau incluant les lacs pluviaux et les lacs de barrage glaciaire, ainsi que l'évolution des cours d'eau incluant le problème des crues catastrophiques dues aux ruptures de barrages glaciaires comme les jökulhlaups ; on y voit aussi l'activité éolienne. Le chapitre sur l'activité volcanique, lui, met en évidence l'importance stratigraphique des dépôts de cendres et la relation entre les périodes d'activité volcanique et certains refroidissements climatiques. Les deux autres chapitres portent sur les déformations de la croûte terrestre et les variations du niveau marin relatif ; ces chapitres sont très succincts et nous laissent parfois sur notre faim.

Enfin, le dernier chapitre est une introduction à la théorie des variations de l'insolation de Milankovitch, et des relations entre les cycles qui en sont déduits et les variations climatiques.

Malgré les lacunes mentionnées, le manuel est suffisamment bien construit pour être recommandé, d'autant plus que son prix est très abordable, même pour les étudiants.

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Parent, M., Dubois, J.M.M., Bail, P., Larocque, A. et Larocque, G., 1985, Paléogéographie du Québec méridional entre 12 500 et 8 000 ans BP: Recherches amérindiennes au Québec, v. 15 (1-2), p. 17-37.

Dougal Dixon's Dinosaurs

By Dougal Dixon
 Boyds Mills Press
 Honesdale, Pennsylvania
 160 p., 1993, CDN \$24.99

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Dougal Dixon is respected, even revered, by paleontologists and science fiction enthusiasts alike for three excellently illustrated and imagined books. In the first of these, *After Man: a Zoology of the Future* (1981), the possible evolution of animals in a world swept clear of mankind was visualized; it included such excellently conceived yet perfectly possible creatures as pygmy shrews adapted to an existence as parasites upon larger mammals, and bats that had become fully terrestrial on an isolated oceanic island. In the second, *The New Dinosaurs: an Alternative Evolution* (1988), Mr. Dixon attempted an interpretation of the likely trends in dinosaur development, had those reptiles not become extinct 65 million years ago. The third, *Man after Man: an Anthropology of the Future* (1990), visualized the possible trends in the physical evolution of man. I found it fascinating, although my daughters considered his drawings rather horrific! These three works all represent splendid exercisings of an unusually vivid, yet logical imagination, combined with an outstanding artistic ability. They are destined surely to become classics.

When Mr. Dixon produces a more rigidly scientific book on dinosaurs, albeit one destined essentially for a juvenile audience, one expects a combination of excellent illustration with good paleontology and originality of presentation. This book amply fulfils these expectations.

First of all, the presentation of the book is attractive. The thematic organization is logical. There is an introductory chapter, setting the geological scene; second and third chapters examining selected genera that well exemplify the whole plexus of dinosaur adaptations to different modes of life; a fourth chapter considering in closer detail their anatomy, senses and social organizations; and a fifth that examines

the history of the discovery and study of the dinosaurs. The book was edited for accuracy by Peter Dodson and Jack Myers; there are some superficialities, perhaps, but I noted no factual errors. The text is clearly written and well printed, as, indeed, is the whole book.

Yes of course, the illustrations are good and quite often excellent; how could they be otherwise? However, it is here that Mr. Dixon's freshness of approach is evident. Alongside his reconstructions of the extinct dinosaurs, he places photographs of living animals that follow a comparable way of life. Some of these are predictable associations: of *Brachiosaurus* with a giraffe, or of a *Coelophysis* pack with a pack of wolves. Others represent a greater originality; thus the fishing techniques of *Baronyx* are compared with those of a grizzly bear, the grazing of *Iguanodon* with that of an okapi, and migrating ceratopsians with migrating wildebeests. Such comparisons valuably furnish an added dimension to our understanding of the dinosaurs.

The illustrations on pages 8-13, of an evolutionary parade of the dinosaurs, is done in light colours and is somewhat confusing. A better rendition in brighter colours, produced as a large poster with black background by the publishers, is much more satisfactory and will make an excellent wall chart for classes up to the university level. The book itself, although designed for a younger audience, should nevertheless be helpful to upper-level students, because of its exceptional lucidity of presentation.

All in all, then, this work belongs firmly in the top league of the copious writings upon dinosaurs. Author/artist Dixon, his advisors, and his publishers alike merit congratulation on a work excellently conceived and equally excellently executed.

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