Green Business Opportunities. A quarterly brought out by the Confederation of Indian Industries, Environment Management Division, India Habitat Centre, Zone IV, IV Floor, Lodi Road, New Delhi 110 003. 1995. Vol. 1. Annual subscription: India Rs 250, Overseas US $30.

Having seen three of the first four issues (the July–September issue did not reach the *Current Science* office), I have very positive comments for this magazine. Its objective is to provide solutions to translate awareness of the ecological crisis into a commitment. The contents of these three issues – information on new technologies, case studies of sound environment management and most importantly, a highly useful feature on 'waste exchange' show that these objectives have been very successfully achieved.

To begin with, *Green Business Opportunities* addresses a long-felt and crucial need for a forum where industries can discuss the environment-related problems. The importance of this at the present time cannot be overemphasized. Secondly, it identifies the most important insight in the very first sentence of the very first editorial – 'The key factor in environmental management is the human element.' It rightly points out the pleasure we take in crisis management, and stresses the need to see to it that environment-related crisis does not arise. Thirdly, it seems to practice what it preaches – editorial of the second issue points out (in addition to the overwhelming response for the first issue!) the suggestion they had received for using recycled paper for the magazine, and the fact that they have indeed done so. This is apparent from the quality of the cover page.

The regular features contain Policy Round Up – a set of informative articles and discussions on topics relevant to the policy aspects of environmental management (e.g. Montreal Protocol). The face-to-face section has a detailed interview with someone with considerable experience and expertise in the field. The usual news/events section describes forthcoming meetings/workshops etc. Somewhat simple-minded cartoons expounding well-known platitudes act as fillers.

One of the most important sections – wealth from waste – describes case studies of effective environment management. Some very heartening success stories of reduction in boiler oil consumption, recycling of waste water, etc. should give the necessary impetus for other industries to follow suit.

The utility of this magazine is further enhanced by the 'waste exchange' bank, which describes – in a well-designed format – wastes available for disposal (e.g. filter press cake, fly ash) from some of the industries, which could serve as input to other industries. The readers' service card enclosed with every issue would make it even easier for readers to request for specific information – such as the new 'green' technologies described in every issue.

On the whole, this would be a very welcome addition to the libraries which cater to readers interested in environmental science and technology, besides being of great use as a source of business opportunities.

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Paleobotany: Plants of the Past, their Evolution, Paleoenvironment and Application in Exploration of Fossil Fuels. Sripad N. Agashe. Oxford and IBH, 66 Janpath, New Delhi 110 001. 1995. pp. x + 359. Price: Rs 150.

Palaeobotany is potentially the university course with a very wide general appeal in both the plant and earth sciences. It is one of the most cross-disciplinary of all the sciences, encompassing as it does knowledge of plant biology, historical geology, stratigraphy, meteorology, biochemistry, etc. and deals with everything from origin of life to evolution of angiosperms, from climates of the past to search for oil- and coal-deposits. Because of encyclopaedic complexity of the subject, very few people have a really adequate grasp of the subject, and still fewer know how to write about it. Most of the acclaimed palaeobotany texts published so far, whether it was Chester Arnold's *An Introduction to Paleobotany* (1947), Sergei Meyen's *Fundamentals of Palaeobotany* (1987) or Tom and Edith Taylor's *The Biology and Evolution of Fossil Plants* (1993), put emphasis on palaeobotany in its classical aspect, that is, enumeration and description of different categories of fossil plant taxa recorded from various geological time slices, and their inter-relationships. A great majority of the examples used in these texts is from the western countries and of little importance to students in India. Except for Henry Andrews' *Principles of Paleobotany* (1960), in no other textbook, palynology, that is, study of pollen, spores, dinoflagellate cysts and other microfossils finds an important place, although it has emerged as an important tool in the search for coal- and oil-deposits. One, therefore, had great expectations from Sripad Agashe's book *Paleobotany: Plants of the Past, their Evolution, Paleoenvironment and Application in Exploration of Fossil Fuels.*

The book is not difficult to read but the subject matter is often incoherent. It appears as if audio-tapes of class-room lectures were transcribed and printed without much editing. Many a chapter reads like a review article. Some of the information seems to be disinformation. For example, 'Plant remains which are younger than 1 million years are normally studied in archaeology' (p. 1). Now archaeology is the study of life of the ancient peoples and reaches back in time only for a few thousand years; archaeological botany is concerned only with those plant remains which indicate human activity. In the *Catalogue of Indian Fossil Plants* (1976) published by Birbal Sahni Institute of Palaeobotany, all vegetative remains that are older than Historic Period are considered as fossil plants. Similarly, 'primary objective of studying paleobotany is to satisfy the curiosity of human mind . . .' (p. 2), is too simplistic a statement which may have been true during the time of the pioneers. On p. 46 the primary purpose of studying plant fossils changes 'to compile a complete story of plant evolution on the earth's surface'; it is not clear if the plant evolution in the waters (life originated in the oceanic waters only) is excluded. 'Preservation and types of fossils, paleobotanical techniques used in studying them, geological time scale, methods to determine geological age of rocks and fossils . . .' hardly qualify as

'basic principles of paleobotany' (p. 2). It is also not judicious to teach the student that Luck is 'an important, almost essential factor' (p. 3) in studying fossil plants, or that 'The exact origin of the earth has puzzled the man ever since he appeared on the earth's surface' (p. 9). One does not really know the thought process of the earliest man. D. C. Bharadwaj, K. M. Lele, B. S. Venkatachala and Vishnu-Mittre are counted amongst students of Birbal Sahni; T. S. Mahabale, D. D. Pant, A. R. Rao, S. D. Saksena, V. B. Shukla and B. S. Trivedi are reported to have been trained at the Institute of Palaeobotany; A. K. Ghosh is said to have taken palaeobotany to Calcutta from Lucknow; R. N. Lakhanpal (1970) is included amongst those who gave historical accounts of Indian palaeobotany; Shaila Chandra is counted among those who worked exhaustively on Deccan Intertrappean flora; and India is projected as a southern continent. None of this is borne out by available information.

Chapters 3 and 4 deal with topics with which the author apparently is least familiar. In Chapter 3, the radius of the earth is given as 4700 miles, and its diameter as 7927 miles. We were taught that diameter is twice the radius! And, did we not switch over to the decimal system of measurements long back? The statement 'it is historical geology which deals with the geological history of the earth' is a non-statement. The author goes on to state that a *simple protoatmosphere* was created out of earth's *original atmosphere* as if protoatmosphere does not mean the original atmosphere. The author's definition of the term geology 'as the science of the earth' is also pedestrian. Even Webster has given a better meaning – 'the science dealing with the earth's crust and the development of its layers, including the study of rocks and fossils'. The Geological Column and the Geological Time Scale discussed in Chapter 4 have many flaws. Foremost is the time of origin of the earth which varies from 4500 Ma (p. 18) to 4600 Ma (p. 21) to 4500–5000 Ma (p. 77). Jim (James Morton) Schopf is credited to have made very significant contribution to Precambrian palaeobotany. Actually, it is his son Bill (James William) Schopf. Only one record from India finds mention in the Chapter on Precambrian biota; but an Eocene record of *Escherichia coli* is included in the same chapter. Dates and authors of some of the geological systems are also wrongly ascribed. Permian System was named by Roderick Impey Murchison in 1841 and not in 1814. The term Jurassic was coined by Alexander von Humboldt (1795) and not by William Smith (1797–1815); Jurassic was recognized as a system by Leopold von Buch in 1839. The term Tertiary is to be ascribed to Arduino (1760) and not to Adolphe Brongniart. Even the discussion on Indian Geological Time Scale contains several obsolete terms, such as, Purana, Dravidian, and Aryan eras. The terms 'system', 'series' and 'stages' have been recklessly used. Division of Barren Measures into Kulti stage and Ironstone shales, and of Raniganj series into Mahuda, Raniganj and Kamti stages (p. 205), and inclusion of Kamthi series in the Middle Gondwana (p. 237) are unique to this book. The author seems to be confused between relative age and absolute age of the rocks/fossils. Dendrochronology (tree-ring study) does not give absolute age of the wood in the geological time scale; at best it gives the age at which the tree died, and may also reflect upon certain known chronological episodes/events. The same is true for growth rings in certain animal shells, and for varves.

Chapter 5 on the types of fossil plants and techniques for study deals with a very important aspect of palaeobotany, but is one of the most incoherent of all the chapters. Otherwise, who would write about site of active sedimentation (pp. 46 and 298), or immediate burial for preservation as fossils (p. 47), or consolidation of sediments due to water evaporation (p. 48), or petrifaction as one of the most common types of fossil with much of the original organic matter preserved (p. 52), or impressions with or without organic carbon (p. 210), etc.

Even the system of classification of the Plant Kingdom discussed in Chapter 7 has many errors. Firstly, the term Tracheophyta was not formally proposed as a taxon of Division rank by Eames (1936). Secondly, Pteropsida of Eames included Filicineae, Gymnospermae and Angiospermae, whereas, the author has wrongly equated Pteropsida with the Ferns. In fact, the student needs to be taught about newer ideas about the status of the Plant Kingdom itself, out of which four independent kingdoms, namely, Monera, Protista, Fungi and Plantae have been carved out. This would have avoided reference to 'intermediates between plants and animals' (p. 295). In the arrangement of the text of the book the classification given in Table 7.1 is not uniformly followed. The author does not seem to have a clear concept of different categories of plant taxa and is frequently confused between taxa at the level of Division and Class. Some of the chapters deal with plant fossils at the level of major plant groups, such as, Fungi, Algae, Bryophyta, and Angiosperms, whereas, other chapters deal with plant fossils either at the level of Division or Class. There are two chapters on Division Pterophyta, a division not mentioned in Table 7.1; it probably refers to Class Filicopsida which is mentioned only on p. 208. Articles of the International Code of Botanical Nomenclature are often violated. In Chapter 18, Division Cycadeoidophyta is placed under Division Cycadophyta. Division Coniferophyta has two classes, namely, Cordaitopsida and Coniferopsida, but in Chapter 19 the latter class is not mentioned; on the other hand Division Ginkgophyta is included here, and that too at the level of an order. Glossopteridales is mentioned as an order of Class Pteridospermopsida under Division Pteridospermophyta but is not discussed. Its elements are, however, discussed in Chapter 20 under the Lower Gondwana flora. Even the Gondwana Flora(s), a subject dear to the heart of both palaeobotanists and biostratigraphers in India is wretchedly ill-treated. In this chapter, *Vertebraria*, a known root axis, is described under male fructification of the glossopterids, equisetale *Raniganjia* is included under Sphenophyllales, all known fossil woods are placed under Coniferales, the genus *Gangamopteris* McCoy 1875 is said to have been described as early as 1828 (p. 214), report of *Cyclodendron leslii* is credited to Surange and not to Kar, taxa of species rank are called as genera (p. 239). Srivastava is consistently misspelled as Srivastav, Jayasri Banerji is Jayashri Bannerjee, *Williamsonia sewardiana* is a stem (p. 248), author of *Thinnfeldia* is Townrow (not Ettingshausen), Order Pentoxylales is included under Taxales, and so on and so forth. Glossopteridales, as an order, has received a far better treatment in Stewart and Rothwell's *Paleobotany and Evolution of Plants* (1993). In the chapter on Tertiary Flora of India,

the comprehensive list of Deccan Intertrappean plant fossils is not in the least comprehensive, probably because the exhaustive review of the subject by Bande *et al.* (1988) has not been relied upon. The same is true for the list of Lower Gondwana plant fossils (Table 24.1) which is based on information as old as 1966 and 1974. The two chapters on application of palaeobotany to exploration of fossil fuels, though very welcome additions, could have been better organized. Even a novice in palaeopalynology knows that 'macerated sediment' (p. 292) is not mounted for palynological studies, or that polyvinyl alcohol is not a mounting medium (p. 302), or that histograms cannot be drawn by qualitative analysis alone (p. 293). One can go on adding to this list of errors and omissions, which is large enough to confuse even a seasoned teacher of palaeobotany.

Agashe's book essentially is a poor imitation of its worthy predecessors. Its below-average production, uniformly poor line-drawings, often incoherent running matter, repetitive and many a time out of place statements, and umpteen printer's devils are enough to keep the student at bay. Even the name of Adolphe Brongniart, Father of Palaeobotany, is misspelled as Adolphus Brogniart throughout the book. Both Queen's and American spellings are used, for example, Paleobotany, color, and fossilised, organised, etc. In expression and grammar the book is not better than many High School texts. The author claims to have given 'a good amount of coverage' to Gondwana and Tertiary floras of India, probably that is why, out of the papers by Indian authors listed in the References, almost 15 per cent are those of the author, rest 85 per cent are shared by 50-odd other authors. The Gondwana student is not introduced to the monumental palaeobotanical contributions of Ottokar Feistmantel. Recent contributions on Indian palaeobotany are for the most part not referred. A large number of the publications cited in the text are not listed in the References; quite a few are wrongly cited, and not all the references are arranged in an alphabetical and chronological order. The author and the publishers are also to be faulted for not indicating source of a large number (> 50) of illustrations borrowed/redrawn from published literature. There is supposed to be a concluding chapter on ongoing palaeobotanical research in different countries, etc. (p. 2). I miss this chapter in the Review Copy. In spite of the all inclusive title, this book has failed the expectations of the Indian students, both undergraduate and the graduate. Oxford and IBH Publishers will be well-advised to withdraw this edition of the book, get it properly pre-reviewed and thoroughly edited, and only then print a new edition.

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