

BOOK REVIEWS

Watching the Universe. John Gribbin and **Watching the Weather.** John and Mary Gribbin. Universities Press (India) Limited, 3-5-819, Hyderguda, Hyderabad 500 029, India. 234 pp. and 162 pp. respectively. Price: Rs 140 and Rs 120 respectively.

Here are a pair of nice, slender books from the well-known popular science writing team of John and Mary Gribbin. Although the titles are similar the books are really quite different in character. This is due at least in part to the fact that the subject matter of the books are so different in nature. Paradoxically we know more about the universe than about the weather.

Let us start with the smaller book, the one on weather. The book, published in 1996, grew out of the regular contributions that the authors made to the 'Weatherwatch' column of the *Guardian*. A consequence is that the book contains no diagrams or figures, a great handicap when one wants to understand the physical processes underlying the motion of winds and currents. Another consequence, which I did not really find irritating, is the heavy dose of anecdotal evidence, folklore and myth regarding the weather. To their credit, the authors try to ascertain whether any of these are supported by scientific evidence. The book is an easy read and could be profitably read by anybody with a little curiosity.

The first chapter gives a nice overview of all the factors, including solar heating and the atmospheric and ocean circulations, that affect the weather. From the second chapter I was surprised to learn that astronomical factors, for example the moon can affect the weather; this chapter also considers how the weather might be on other planets. The following chapters discuss the effects on evolution of the changing climate, how people (and history!) have been affected by the weather, the problems of weather forecasting, extreme weather events, myths and legends and finally human impact on the weather. Let me give a small sample of the types of interesting facts that the book gives. Had you heard that there is a scientific basis to the idea, suggested by Goesta Wollin, that the changing climate and the changing earth's magnetic field are correlated? Or that Mary Shelle may

have written *Frankenstein* because of the bad weather in 1816? Would you have guessed that if all the clouds in the atmosphere were instantly turned to rain, it would make a layer of water only 25 mm thick over the entire surface of the globe? Or that hailstones can be as large as cricket balls? The last fact implies that hailstones can be carried up and down a number of times in a cloud by the updrafts and downdrafts before falling to the earth. Quite amazing.

Coming to the second book, I enjoyed reading it and learned a few things from it and have no hesitation in recommending it to the general reader, the science student and to any scientist not working in astronomy or astrophysics. The book consists of seventeen reasonably brief essays first published, between the mid-1970's and the mid-1990's, in the *Griffith Observer* and which were, as the author candidly admits, especially tailored to the presumed tastes of an American West Coast audience.

Although this is not formally indicated, the book is divided into three parts that have been rather seamlessly integrated. The first part deals with terrestrial matters: the possible role of a meteorite impact on the vanishing of the dinosaurs and the consequent rise of the mammals and our own species, the conditions necessary for the evolution of life forms in the universe, the dynamics of ice ages on earth and their relevance to global climate change and the role of geological and biological time scales in the development of proper models of the sun. The second deals with stars and galaxies: the solar neutrino problem, solar variability, pulsars, black holes and galaxy formation. The last part deals with space, time and cosmology. Naturally, the really trendy topics like white holes, the mass of empty space and inflation appear in this part. I liked the first part the best and the third part the least. This could be because my ignorance of biology and geology are greater than my ignorance of astronomy. It could also be because I am more comfortable with matters that are a little complicated and a little boring but understandable rather than with those that are spectacular but understandable and possibly have little basis in fact. In this context the author's quotation from Mark Twain may be relevant: 'there is something fascinating

about science. One gets such wholesale returns of conjecture out of such a trifling investment of fact'.

My own favourite essays are the ones entitled 'Waiting for the next ice age' and 'The curious case of the shrinking sun'. They are special in that they not only describe some remarkable scientific investigations but also beautifully illustrate how science actually works. Sometimes simple effects are not due to a single, simple cause but result from the complicated interaction of a number of causes. Thus in the Milankovich model the ice age rhythms are due to three main astronomical cycles: that of the earth's orbit, the tilt of the earth's axis, and the precession of the equinoxes. Sometimes the verification and acceptance of such a model, after much controversy, takes many decades of detailed painstaking work in different fields. In this case it required significant improvements in the analysis of ice cores and sediments, in dating techniques and in computer modelling before the model could be declared successful. For example, the temperature history of a terrestrial object can be inferred from the proportion of the heavy oxygen isotope, oxygen-18, that it contained at various times. To apply the technique to deep ocean sediments, scientists ingeniously use the oxygen proportions in the shells of small marine creatures found in these sediments! Finally both these essays show how important it is in science to have faith in the essential correctness of current beliefs and still keep an open mind about the possibility that these beliefs may have to be modified to accommodate new data that has come in. Trying to understand nature without the former would be akin to building on quicksand; without the latter would be to risk compromising its ultimate integrity. How difficult it is to walk this middle path is shown in Gribbin's fine essay on solar variability. Is the sun really shrinking, can the measurements be believed, does this solve the neutrino problem, how does this affect our weather – an intriguing story with a good moral.

The book does have some faults. Errors in a popular science book are more serious because the audience is a general one. Typographical ones, such as the missing factor of a half on page 11, are less serious; more so are sim-

plistic statements such as 'During the fireball stage of the Big Bang, the sky was ablaze with light throughout the Universe...'. In fact, the tendency to oversimplify matters together with the conversational style adopted to attract the target audience is at times irritating and misleading. This is especially so in the third part of the book dealing with all the hot topics. The problem of how much to simplify is one that has to be faced by all science popularizers. Generally a good policy is to refrain from trying to tell the whole truth while avoiding all that is false. Still, all in all, it is a good book.

Books such as the ones reviewed here would be ideal prizes for good scholars, winners of competitions, etc. They have the capacity to stir our curiosity, to amaze and enlighten us and are brief and eminently readable. If many dozens of books of this type were available over the whole spectrum of scientific subjects and many students were encouraged to read them we would have far better motivated students than we have at present. And that is finally what counts.

P. N. SHANKAR

*Computational and Theoretical Fluid Dynamics Division,
National Aerospace Laboratories,
P.B. No. 1779,
Bangalore 560 017, India*

Gravity and Magnetic Interpretation in Exploration Geophysics. I. V. Radhakrishnamurthy. Memoir 40, Geological Society of India, P. B. 1922, Gavipuram P.O., Bangalore 560 019, India. 1998, 368 pp. Price: Rs 500.

This book fulfills a long standing need of students and geophysicists who require software to model the potential field data acquired by them. The author has made this task easy by providing software required for modelling gravity and magnetic field data on a floppy.

This book primarily deals with the gravity and magnetic methods of geophysical exploration and describes the basic principles and concepts concerning these methods in the first chapter. It

also describes the various corrections and procedure for reduction of field data and provides a software to obtain the magnetic elements according to IGRF 95. However it does not provide the requisite software for corrections and reduction of the field data. Chapter 2 provides a general background for interpretation of gravity and magnetic field data and the necessary processing before modelling them in terms of causative sources. The necessary software for operations like trend surface analysis, continuation of fields, various derivatives of the observed field, etc. are given in this chapter. Fourier coefficients are used for the continuation of fields and derivative maps which can be more efficiently computed using Fourier transform and specially FFT subroutines.

Chapters 3 and 4 deal with the interpretation and the modelling of gravity data. Simple shaped bodies like sphere, cylinder, etc. are first described and then complex 2-D and 3-D bodies using polygonal cross-sections. Similarly, Chapters 5 and 6 deal with the interpretation and the modelling of magnetic data. Some of the simple methods (thumb rules) given in these chapters are useful for quick assessment of field data without the aid of any machine in the field.

The software given in these chapters are self-sufficient implying that initial values for the model are obtained automatically based on the characteristics of the field data and some preliminary computations at the beginning of the exercise. In this regard, there may be some problems while applying them on actual field data specially the inversion schemes which may lead to the results which may be totally different from the geological point-of-view in an area. We faced some problems in this regard while inverting anomalies due to a fault and vertical cylinder using the software given in this book. It might be due to the fact that the geological bodies cannot be truly represented by physical models and therefore interaction with an experienced interpreter for an appropriate model is important. Therefore, it might have been better to have some scope for interpreter to choose initial model as per the geological and other available information from the region.

This book is very well written and will be extremely useful to the earth-scientific community. The weakness however lies in the application to actual field data and demonstration of some of the software to real dataset, which might have not been done probably due to lack of space. Several descriptions and computer programs have been verbatim adopted from Radhakrishnamurthy and Mishra (Radhakrishnamurthy, I. V. and Mishra, D. C., *Interpretation of Gravity and Magnetic Anomalies in Space and Frequency Domains*, Assoc. of Explo. Geophs., Hyderabad, 1989, pp. 1-249) which is not mentioned in the references.

D. C. MISHRA

*National Geophysical Research Institute,
Hyderabad 500 007, India*

Geology of Rajasthan. S. Sinha-Roy, G. Malthotra and M. Mohanty. Geological Society of India, Gavipuram P.O., Bangalore 560 019, India. 1998. 278 pp. Price: Rs 250.

The Geological Society of India deserves to be congratulated for bringing out textbooks on the geology of different states of the Indian Union. Quite a few books in this series have already occupied our shelves. *Geology of Rajasthan* is the latest addition to this series. An immediate attraction of the present book is its small size with a moderately low price.

The book under review will satisfy the long-felt need of an integrated account on the geology of Rajasthan under a single cover. The authors seem to have succeeded to a great extent in piecing together the disparate information on the geology into a coherent geological story covering a protracted span of 3,500 m.y. before the present. It may, however, be a matter of debate whether the authors are successful in constraining the descriptions within the bounds of the objectivity. Yes indeed, on several pages we note a liberal fusion of description with interpretation (mostly of the authors!).