

BOOK REVIEWS

(GISP2) drilled a core about thirty kilometres west of the GRIP site during 1989–1993. These cores penetrated more than 3 km of the ice layers and revealed new and fascinating clues about how the climates changed in the past ~100,000 years. This study, extensively corroborated by the independent findings of the European and US scientists had led to new ideas of how the earth's climate machine operated in the past, and is the prime reason for the book.

Straightforward and easy to understand answers to the 'why' and 'how' climate questions can be found in the book. Alley leads the reader through recent discoveries about climate changes, such as large temperature shifts (15°F) within a decade or less, possible causes of these changes which serve as amplifiers of small changes in the earth's heat budget. He discusses evidence related to triggers such as the Heinrich events, signifying a prominently ice-rafted debris accumulation at the sea floor, which are found extensively in the North Atlantic. Each of the layers is only a fraction of an inch thick on the east side of the ocean, but the debris layers are much thicker towards north and west of the Hudson Bay and greater than a foot thick just outside the Bay. What brought about these rapid advances of the ice, which had accumulated during cooler periods in the Hudson Bay, and what was the effect of this advance on the ocean and the global climate? The book continuously makes one aware that climate is an end product of complex interaction between the atmosphere, land and the oceans (where most of the earth's heat is stored). Therefore, climate models have to consider their role explicitly, guided by various observational data, the relevance and the importance of which can be appreciated only if *records* with high time resolution are available! A modeler must consider all the facts, which strengthen not only the deduced climatic scenario, but in the final analysis, make it possible to reach a consistent theoretical framework for the observations.

Richard Alley, an internationally recognized scientist for his contributions to the study of the GISP2 and other ice cores, has written the book in a very easy-going style, depicting quite manifestly how he developed his own

thinking while doing research on the ice samples from the GISP2 core. At the drilling site, Alley spent many months each summer hunched over a light table, deep in a snow cave. He concentrated on looking for the subtle dust bands that define the annual layers in the core. The task required tolerance of both cold and monotony. Alley also had a side lab deep underground where the orientation of the ice crystals, which has a strong influence on how the ice responds to stress, was measured. There were always a few students around too. At least half a dozen of them have developed their own successful careers by following through on projects that Alley passed off to them. Alley's main contribution to the GISP2 project was a systematic approach to visual inspection of the core. This low-tech approach identified the abrupt factor of two changes in accumulation that occurred during major climate changes and was crucial for understanding the extent of the flow-induced stratigraphic distortions that occurred in the bottom 10% of the core. The visual observations also played a key role in dating the core by identifying annual layers. He was also a leading force in synthesizing data and concepts from the ice, oceanography and modelling communities.

Throughout the book, the author has tried to simplify the complex climatic processes using simple cartoons and analogies! It is a matter of opinion whether these simplify one's understanding or simply make one believe that one has grasped the basics of the processes. But it is quite clear to me that an inquisitive scholar looking out for a subject for his research would be swayed towards this challenging task of understanding earth's past climates (including what type of climate one may expect in the future, on which the author has spent quite some time towards the end of his book). An important section in the book is the one on 'Sources and related information' which should provide ample information to the reader interested in pursuing the subject in greater detail. An intriguing point is why Alley chose to use non-scientific units in this book: mile, foot and the pound. He chose to do this because, as he comments in Appendix 2, he felt that the *Two Mile Time Machine* sounded better than the *Three-Kilometer Time Machine!* Then, for consistency, he kept

the mile, foot and the pound in the book; but feeling guilty he gave the conversion factors in the Appendix.

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Cretaceous Stratigraphy – An Update. A. Govindan (Guest Editor). Geological Society of India, P. B. 1922, Gavipuram P.O., Bangalore 560 019. 2000. 426 pp. Price: Rs 600/\$50.

The Cretaceous was a pivotal period in the earth's history when an old order of organisms diversified and became extinct, giving way to new life forms of a more modern aspect. It is, therefore, appropriate that special attention be paid from time to time on various aspects of this period, specially in the Indian context. The latest review in this direction is the commendable effort by A. Govindan, who is the Guest Editor of the Franz Kossmat Volume on *Cretaceous Stratigraphy – An Update*.

During the turn of the last century several geologists from Austria visited India and made significant contributions. Franz Kossmat (1871–1938) was one of these. The present volume gives tribute to this man, who highlighted the classic sections of the Indian Cretaceous, first for his Ph D thesis and later made them known globally.

The present volume is divided into seven sections. The first four articles in the section dealing with Cretaceous sea level and stratigraphy lay down the basic principles for Cretaceous stratigraphy in the context of marine oscillations with reference to specific case studies.

The section on palaeontology constitutes the next comprehensive part of the volume and comprises a mixed bag in which a variety of fossil groups ranging from nanofossils to molluscs have been described. Several papers presented as extended abstracts also pertain to this section.

There is only one review paper dealing with the temporal framework of the

Ptilophyllum flora in the section on palynoflora.

Of the three papers presented here on palaeoenvironment, two are concerned with Lameta palaeoenvironments.

In the next two sections dealing with sedimentology and economic aspects, the main emphasis of the five papers highlight work on the Cauvery, Krishna–Godavari and Meghalaya Basins.

Lastly, recent data on the Jurassic–Cretaceous, Cretaceous–Tertiary and boundary problems have been highlighted.

All in all, this volume gives updated comprehensive information on current ideas on a variety of crucial issues in the context of the Indian Cretaceous. I am sure that the Franz Kossmat volume will serve as a ready reference to geologists interested in Indian Cretaceous

stratigraphy. This book is a fitting tribute to the man whose name appears on the title cover page.

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Current Science

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