

carboxysomes. The regulation of genes involved in Calvin cycle and carboxysomes is well described by Shively, van Keulen and Meijer.

Micro-organisms also produce some novel enzymes that can be exploited for useful biotransformation reactions. Patel describes the novel approach of synthesis of paclitaxel, an anticancer drug (normally extracted from bark of Pacific yew trees at a very high cost) by biocatalysis with three novel enzymes obtained from the same plant species *Taxus*.

Modern world faces a serious problem of waste water treatment to remove several natural and man-made organochlorine compounds, that are causing severe and potentially irreversible ecological and environmental damage. Scientists are exploring ways of dealing with them. Lee, Odom and Buchanan review the normal measures involving microbial pathways of dechlorinating the toxic chlorinated aromatic compounds and converting them to nontoxic or metabolizable compounds. Other approaches to deal with the bottlenecks in microbial conversion of chloroaromatics involve genetic engineering of hybrid pathways, whereby genes for enzymes that degrade the toxic intermediates further, into the organism. These novel approaches and their mechanisms are reviewed by Reineke.

The specificity of transcription activation in prokaryotes is regulated by sigma ( $\sigma$ ) factor that in turn controls the transcription of several housekeeping genes. In addition, several bacterial species undergo developmental changes like sporulation, flagellar secretion, stress response, etc. These developmental switches require new sets of genes to be expressed, which require specific  $\sigma$  factors. To achieve this, different bacterial species possess the anti-sigma factors, which abolish the function of the housekeeping  $\sigma$  factor and allow the stage-specific  $\sigma$  factors to express specific genes. The mechanisms of action of different anti-sigma factors from microorganisms like *E. coli*, *S. typhimurium*, *B. subtilis*, etc. is reviewed by Hughes and Mathee.

The unusual phenomenon of thymine less death (TLD) exhibited by bacteria, yeast and mammalian cells, involving cell death of thymine auxotrophs in response to thymine starvation, is reviewed by Ahmad, Kirk and Eisenstark.

This exceptional phenotype is in contrast to biostatic effect of deprivation of other nutritional requirements and is caused mainly by loss of thymidylate synthase. It is accompanied by DNA damage in the form of single and double-strand breaks, which lead to cell death. The phenotype is exacerbated by mutations in recBCD pathway while recF repair counteracts it. This phenomenon is especially interesting since several anticancer drugs and antibiotics inhibit thymidylate metabolism and, therefore, understanding of TLD should help in devising better anticancer approaches.

*Clostridium perfringens*, the bacterium that causes human gas gangrene and food poisoning, produces several enterotoxins some of which are located on large extrachromosomal plasmids and transposons. Rood reviews the molecular biology of regulation of expression of enterotoxin by a two-component signal transduction system and the structure-function studies of enterotoxins.

Viruses exploit the cellular machinery for DNA replication, protein and RNA synthesis to propagate themselves. In addition, by a clever mechanism called virocrine transformation, viral gene products can activate the host cells' growth factor receptors (like erythropoietin) independently of their normal growth factor ligand, leading to host cell proliferation. Alternatively, their gene products may mimic the growth factor receptor thereby stimulating the host cell proliferation. This interesting phenomenon is reviewed by DiMaio, Lai and Klein.

The HIV retrovirus, the causative agent of AIDS, the most serious disease of epidemic proportions in the modern times, executes complex temporal programme of expression of late genes. This is mainly accomplished by the virus-encoded RNA-binding protein rev, which shuttles between nucleus and cytoplasm and plays an important role in transport of late viral mRNA from nucleus to cytoplasm. Because of its central role in regulation of HIV growth, rev also serves as a potential drug target. Mechanisms of regulation of rev and its role in RNA export are reviewed by Pollard and Malim.

The malarial parasite *T. brucei* has evolved intricate strategies for evading

the defense mechanisms of the insect and human hosts, such that the parasite is able to extract its food from diverse hosts with the help of cell surface receptors (like transferrin receptors) and transporters (e.g. for LDL, HDL, etc.); however, these molecules are either not easily accessible to the host immune defence mechanisms or the organism can change its receptor and antigen receptors in a very small population, before the host can build up its defense mechanisms. These molecular strategies, as described by Borst and Fairlamb, should facilitate knowledge-based approaches for identifying new drugs and drug targets.

In conclusion, this volume covers several interesting areas like morphogenesis in prokaryotes, molecular biology of malarial parasite, viral gene regulatory mechanisms and excellent articles on morphogenesis control and aging control mechanisms in yeast. However some repetitions, like as many as three reviews on multicellularity in unicellular micro-organisms, could have been avoided.

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**Annual Review of Earth and Planetary Sciences 1998.** Raymond Jeanloz, Arden L. Albee and Kevin C. Burke (eds). Annual Reviews Inc., 4139 El Camino Way, P.O. Box 10139, Palo Alto, California. Volume 26. Price: US \$75, 771 pp.

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The present volume of the *Annual Review of Earth and Planetary Sciences (AREPS)* which contains nineteen articles, spans a broad array of research fields, from protoplanetary astronomy, marine geodesy, and metamorphic petrology to paleoecology, rock mechanics, and volcanology, the research fields which have made significant progress in the recent years.

Some of the greatest contributions to the geological sciences in the recent past came from geochronologists. They transformed the classical geology and freed it from its 'descriptive' mooring.

Numbers made a difference. For example, the Precambrian was a catch-all term for most of Earth's history, extending from about 600–4500 million years ago. Previously the Precambrians were subdivided into 'early' or 'late', a distinction that more often did not have any basis. Geochronological experiments provided ages of the rocks thereby facilitating mapping and correlation of the provinces. The prefatory article by George W. Wetherill ('Contemplation of things of the past'), presents a personalized view of the development of geochronological methods using mass spectroscopy in which the author was closely associated. The author narrates development of his career through 1950s and 60s, a period which saw blossoming of science in America. George Wetherill's contribution to geochronology has greatly helped geologists to understand the Precambrian geology. Another area where he has contributed much is the dynamics of stray bodies in the inner solar system, the meteorites and asteroids.

The present volume of AREPS contains a rather unusually long article (Steven B. Shirey and Richard J. Walker) on an exciting development in geochronology that is now taking place in Re–Os (rhenium–osmium) geochemistry. The development of high precision techniques provided the necessary boost to its analytical precision. The interest stems from the fact that Re and Os are highly siderophile elements, hence they strongly prefer metal or sulphide phases over silicate minerals. Consequently, Re–Os system can be employed to study cosmochemistry, chemical evolution of Earth's mantle and the origin of noble metal-bearing ore deposits, continental crust evolution, weathering, marine sediments and the chemical evolution of sea water. In another article, Kerry Gallagher, Roderick Brown and Christopher Johnson review the advances made in understanding the temperature dependence of fission track annealing and fission track length distribution (in apatite, zircon, and sphene). The past decade has also seen advances in fission track analysis which again is a geological dating tool. This technique has been applied to resolve a number of questions related to sedimentary provenance, thermal history of sedimentary basins, structural evolution of orogenic belts

and continental denudation. The most common application is of course the dating of rocks. Over the past 10 years, studies have shown that fission track length is critical to the understanding of fission track ages and development of better annealing models. In its application to tectonism, better sampling strategies linked with structural mapping can provide better constraints on the evolution of fault zones.

Magellan data have been used in recent years to decipher the crustal and tectonic processes on Venus. The article on volcanism and tectonics on Venus by F. Nimmo and D. McKenzie synthesizes results from the recent work. This provides an opportunity to compare the planet's evolution with that of the Earth's. Interestingly, no features similar to spreading ridges were revealed from the synthetic aperture radar (SAR) images, indicating that plate tectonics is not active on Venus, except for localized rifting. Another interesting observation is that the faults associated with the rifts could be eight times more stronger than the faults on Earth. One possible reason for strong faults is the absence of water. Although there is no evidence of any overt crustal movements on Venus, mantle of the planet seems to be active with plume processes and mantle convections. The analyses of the SAR images indicate a global resurfacing event (basaltic upwelling) ending at 300–600 Ma. Ever since that catastrophic event, the planet has been heating up. The findings on Venus question the widely held assumptions of uniformitarianism. Size, composition, mantle temperature and lithosphere thickness of Venus are similar to Earth. However, a major controversy lingers on regarding the lithospheric thickness of Venus which has now become an active debate between Dan McKenzie and Turcotte, two renowned geophysicists representing different schools of thought. Turcotte and others suggest a thick lithosphere (~200–400 km) and McKenzie believes it to be a thinner crust (~100 km). Magellan gravity data apparently were not good enough to fully resolve this question. Finally, the question boils down to this: is Venus dying or will it come back to life sometime in future?

One example of catastrophism event on Earth may be the massive effusion of

basaltic lavas during Cretaceous-Tertiary transition. An article, titled, 'The importance of pahoehoe' by S. Self, L. Keszthelyi and Th. Thordarson, reviews the advances made in the study of pahoehoe flows (with ropey surface texture, different from 'Aa' lava with blocky structure) which is the most common basaltic flow even in the continental flood basalt provinces. The recent volcanological studies have provided some understanding of the formation of these types of lava flows and specific processes involved in their emplacement via 'inflation', which was possible after several decades of observations. Inflated pahoehoe flows can attain great size because they are thermally very efficient. This is an important field of study as far as India is concerned. India has one of the largest basaltic lava (akin to pahoehoe) province which developed probably between 68 and 65 Ma with peak volume production lasting possibly < 1 Ma between 68 and 65 Ma. An important question raised in the article is the effect of large-scale eruption of pahoehoe lava flows on the global environment. There is now an incontrovertible evidence for a large 64.5 Ma bolide impact with lethal effects on global biota at a site called Chixulub, at the Cretaceous-Tertiary boundary which is somewhat coincident with continental flood basalt eruptions. The combined effect of these two phenomena could have dealt a body blow to global environment and biotic communities leading to mass extinctions.

An area which received a lot of attention in recent years is paleoclimatology. Fear of sudden climatic changes in the future was an added motivation in pursuing paleoclimatological researches. Proxy indicators including geophysical, geochemical, biological and sedimentological indexes have been used to characterize paleoclimatological changes. Summer and winter monsoon circulations are among the most dynamic interactions of the continent-ocean-atmosphere system on the globe. Extensive loess-soil sequences in north central China offer excellent sites to study the spatial and temporal changes of monsoon during the Quaternary. Chinese scientists have made significant contributions to this study. A major finding is that the temporal and spatial

changes in monsoon in the Quaternary can be linked to global ice-volume variations. In the article, 'Chinese loess and the paleomonsoon', Tungsheng Liu and Zhongli Ding make succinct review of the researches carried out in this field in which most of the original papers are published in Chinese. We have a stake in these studies because India's development largely depends on a steady monsoon. We should be working with the Chinese scientists on these aspects.

Recent years have seen a much more insightful understanding of the processes of faulting and the influence of the internal structure of the fault on earthquake processes. Chris Marone's paper 'Laboratory derived friction laws and their application to seismic faulting' presents models that relate after-slip to the structure of the fault zone, using examples from the San Andreas fault. Although the models explain the absence of slip within the main rupture, the role of gouge in limiting the after-slip remains an open question. A spectrum of behaviours ranging from aseismic creep to accelerating slip or slow precursive slip prior to fully dynamic instability is governed by friction laws. However, as the author himself points out, the field observations and models need to be tested by specific laboratory studies and development of theoretical models.

Richard G. Gordon's article on 'the plate tectonic approximation' deals with basic assumptions that underlie the theory of plate tectonics. The validity of the two central assumptions on the rigidity of the plates and the narrowness of the boundaries forms the theme of this paper. Apparently, both these assumptions are contradicted by many observations, both in continents and oceans. In his reconstruction based on the strain rates and relative velocity of plates, diffuse plate boundary zones cover 15% of earth's surface. While some important issues on rigidity of the plates and misfits of plate reconstruction remain unclear, Gordon makes no effort to examine the global seismicity and stress patterns, considered as clear manifestation of plate deformation.

The metamorphic terranes of south India offer excellent type areas for studies of charnockite formation and its association with CO<sub>2</sub> infiltration. Researches into these aspects both by

Indian and non-Indian scientists provided a better insight into the nature of transportation during metamorphism. John M. Ferry and Martha L. Gerdes base their arguments on those findings and other work and highlight the stable isotopic, mineralogical, and chemical alterations during metamorphism as evidence for reactive fluid flow. However, the fact remains that as far as granulites are concerned, the role of reactive fluid flow continues to be controversial because transportation can be both by fluid flow (advection) and by diffusion within the fluid or the solid state. Isotopic, mineralogical and chemical data from granulite terrane of south India suggest discrete development of granulite along fractures indicating infiltration of CO<sub>2</sub>-rich fluid. In contrast, studies in the Adirondack area record fluid-absent conditions in the granulite development. Future studies will try to resolve this by improving the database on both chemistry and mechanics of fluid flow.

There has been a significant growth in the application of advanced technologies in earth sciences. The advent of modern satellites has revolutionized the methods of data gathering and management. Two exhaustive articles in AREPS deal with use of satellite in deciphering sea floor tectonic fabric and oceanic circulation. Besides, there are papers on the study of presolar grains from meteorites which in fact is star dust (how poetic this word is!) that are ejected from supernova prior to the formation of solar system. Laboratory studies of these grains provide information on stellar evolution. Another fascinating article deals with early history of insect-plant association. In short, the 1998 AREPS volume covers a wide range of topics in earth and planetary sciences, most of them on emerging research areas. These papers not only provide an introduction to the respective research fields, but also serve as a gateway to the current literature. We have no hesitation in recommending this book to the students as well as the professionals.

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**Illustrated Text Book on Sericulture.** Translated from Japanese: Zukai Sangyo Dokuhon. Japan Sericulture and Agriculture Cooperative Association Confederation, Tokyo. 1967, 159 pp. Translated by Alamelu Gopal, Technical Editor, D. Mahadevappa. 1998. Mohan Primlani for Oxford & IBH Publishing Co. Pvt. Ltd, 66, Janpath, New Delhi 110 001. Price: Rs 275.

As stated by the Board of Editors (May 1967) in the Preface of the book, this is a textbook of sericulture technique(s) illustrated with detailed photographs, figures and tables. The attempt is really refreshing as the reader gets easily familiarized with the subject matter. What is, however, disappointing is that the matter presented in 1967 is being translated into English only in 1998, almost 31 years later; although the editors say that the latest information is given, the 1967 edition does not quote 'revised'. The entire subject of the textbook is exclusively applicable to Japanese sericulture only.

The first chapter, mainly devoted to mulberry cultivation (65 pages), is justifiable because the culture of mulberry (moriculture) forms the basic foundation of sericulture. Mulberry leaves form the sole food material of commercial silk producing silkworm *Bombyx mori*. L. The success of sericulture industry is mostly dependent on good quality mulberry leaves. The relationship of leaf quantity and yield to number of branches and unit branch length is well discussed with tabular representations. Detailed information about mulberry varieties is compiled. Planning of mulberry fields and their establishment with respect to young age and late age silkworm rearing are neatly presented. Easy and simple methods to determine the planting distance are shown. An account of various methods of training and harvesting of mulberry for silkworms of different maturity (young and adult) is beautifully illustrated. There are photographs depicting mechanization of mulberry field management.

The diseases and pests of mulberry and their management are covered in detail. This is an important aspect of mulberry cultivation. But many shortcomings are noticed. To cite a few: the photographs do not clearly show the