

## COMPTE-RENDUS - BOEKBESPREKINGEN

M.L. COLEMAN, C.D. CURTIS & G. TURNER - *Quantifying Sedimentary Geochemical Processes*. Oxford University Press, Saxon Way West. Corby NN 18 9ES, England. 1994, 186 p. ISBN 0-19-854831-1. Price : £ 35,00.

The book is a collection of papers presented on a Discussion Meeting on the quantification of sedimentary geochemical processes, held on 26 and 27 January 1993. The papers have already been published in Philosophical Transactions of the Royal Society of London.

The book is subdivided into six quite different topics: sediment supply, early diagenesis in carbonates, early diagenesis and microbial activity, diagenesis of organic matter, burial diagenesis and deep fluids, and basin scale processes.

In a first paper, Curtis and Douglas analyse the diagenetic processes in fine-grained clastic sediments. They suggest that bed-parallel changes in the intensity of diagenetic modification (e.g. cementstone horizons) and marked changes in the authigenic mineral assemblages are caused by changes in sediment supply rate, driven by climatic fluctuations. However, the major part of the article focusses on fluctuations in sedimentation rate and sediment composition and hardly integrates diagenesis. The second paper on sediment supply has been written by Parrish, Demko and Tanck and summarizes the key factors that determine marine and continental sedimentation. They do not provide specific examples or illustrations.

Walter *et al.* investigated the earliest diagenetic processes affecting modern, shallow marine and carbonate sediments. Their geochemical data from pore waters and solid phases indicate that the isotopic and elemental composition of carbonate minerals can experience significant alteration during earliest burial. This alteration is driven by chemical exchange among carbonates and decomposing organic matter. This paper has significant implications for the interpretation of shifts in the carbon isotope age curve for marine carbonates. In the second article on early carbonate diagenesis, Parker, Titiloye and Watson discuss a computer simulation technique which will predict the surface structure, the morphology and the rate of growth of carbonates.

The importance of microbial processes in early diagenesis is illustrated in three papers. The rates of microbial processes in sediments have been studied by Blackburn and Blackburn. The following methods of measurement of sediment parameters are discussed :

- rate of diffusional exchange of reactants and products across the sediment-water interface ;
- the concentration profiles of these reactants in the sediment ;
- profiles and integrated rates of reactions in the sediment.

The interaction of the processes of reaction and diffusion are illustrated using a simulation model. White presents in his paper an *in situ* method for the quantification of the microbiota in sediments and soils, based on the extraction of «signature» lipid biomarkers (SLB) from the cell membranes and walls of microorganisms. In the last paper on microbial activity, Coleman and Raiswell investigated the origin of carbonate concretions. Pyrite-rimmed, spheroidal carbonate concretions from the Jurassic resulted from outward diffusion of microbially produced sulphide which reacted with inwardly diffusing iron. Extensive, bedded siderite concretions in the Carboniferous Coal Measures were formed by microbial reduction of Fe (III) which could only proceed because the reaction was buffered by precipitation of carbonate produced by methanogens degrading more deeply buried organic matter. Simulations of the Jurassic concretions' growth process give results which correspond with the spatial distribution of mineral precipitates observed in geological samples.

In the chapter on the diagenesis of organic matter, Alpin and Macquaker describe the main reactions involving C-S-Fe during both early and deep burial diagenesis of mudrocks, and they explore the crucial influence of early diagenetic reactions on deeper processes. A quantitative assessment of the changes occurring in organic matter during earliest diagenesis is provided in a paper by Lewis and Rowland. The authors examined the concentrations of 'proteins', 'carbohydrates' and free and 'bound' lipids in 1 cm sections of offshore Peru sediments. The concentrations of major biochemicals in the sediments show evidence for the rapid diagenetic alteration of the organic matter. Significant reductions in 'protein', 'carbohydrate' and 'bound' lipids occur within about 50 years. Changes in the free lipids may be more complex.

The synchronous oil migration and cementation in sandstone reservoirs has been demonstrated by a quantitative description of a burial diagenesis (Emery *et al.*). The fields are characterized by a rapid deterioration of reservoir quality. A descending oil-water contact and associated diagenetic zones explain the geochemistry and distribution of major oil, burial silicate and carbonate phases in the reservoir and the deterioration of the reservoir quality. In a second

paper on burial diagenesis, Turner *et al.* describe some new technical developments applicable to a wide range of geological problems. Using a VG Isolab 54 ion microprobe with multicollection, they made reproducible  $^{18}\text{O}$  measurements with a spot size of 20  $\mu\text{m}$  and a precision of 1 %. Noble gas isotope analyses of fluids in inclusions have been carried out to deduce the origin of the fluids. The origin and basin scale movement of fluids has also been investigated by O'Nions and Ballentine using rare gas abundances and isotopes. The mass balance of atmosphere-derived and crustally produced radiogenic rare gases in natural gas reservoirs allows straightforward constraints to be placed on scales of fluid movement in sedimentary basins. The paper deals with groundwater flow and fluid focusing in Neogene basins and the scales and mechanisms of crustal degassing.

Menjöz *et al.* investigated the present day flow in the Dogger reservoir on a basin scale (Paris Basin). Regional flow at basin scale is obtained by numerical modelling using two main hypotheses : homogeneous constant fluid density and variable density associated with detailed reservoir topography. The validation of flow modelling results is verified using the coherence with the induced effects (geochemical and thermal anomalies, existence of confined and mixing areas). The last paper of the book by Ortoleva is on self-organization and nonlinear dynamics in sedimentary basins. The examples discussed include intracrystalline oscillatory zoning, millimetre- to metre-scale differentiated layering and stylolites, Liesegang bands, reaction front fingering, pulsatile fluid release from overpressurized zones in deep basins, and kilometre-scale basin compartmentation.

Notwithstanding the high quality of most papers, it is not clear why the papers first published in Philosophical transactions of the Royal Society of London, are published again in a book. The articles do not provide a complete overview of the present knowledge on the quantification of sedimentary geochemical processes and no relation between the different topics/chapters in the book is given.

Ph. MUCHEZ  
K.U.Leuven

R. VIALLY (Ed.) - *Bacterial Gas. Conference September 25-26, 1989. Milan. Editions Technip, Rue Ginoux 27 -F-75737 Paris Cedex 15. 1992, 242 p. Price : 560,- FF. ISBN 2-7108-0620-7.*

While some time ago natural gas was considered by some explorationists to be an embarrassing by-product of oil, that at best should be flared off at the well site, nowadays it has become a prime exploration target.

The reasons are straightforward ; advances have been made in the liquefaction of natural gas, and transportation is now possible over long distances (pipelines/gas tankers) ; gas is rapidly becoming economic in areas where oil reserves are either poor or declining ; and finally gas has significant environmental advantages compared to oil being less of a pollutant and more effectively convertible into energy.

Sharply increased rates in gas consumption are forecasted until the end of this century. In Europe, the Netherlands and Italy are actually, the key consumers of gas with 42 % and 25 % respectively of their annual primary energy demand covered by this resource. Exploration for gas is generally less advanced than exploration for oil, with the implication that major discoveries are still likely.

To facilitate exploration and to increase its success rate, the processes resulting in the generation and accumulation of natural gas need to be better understood. Bacterial gas is generated by the anaerobic microbial decomposition of organic matter at low temperatures, and it is estimated to represent around 20 % of the world's natural gas resources.

Numerous scientists from disciplines as diverse as microbiology, biogeochemistry, geology and agricultural chemistry are involved with the study of bacterial gas, and in 1989 an international scientific conference was organized jointly by AGIP, the International Union of Geological Sciences (IUGS) and the Institut Français du Pétrole (IFP) in Milan to address this broad subject.

The aim of the Milan conference was to unite as many of these different disciplines as possible, in order to contribute to the building of a body of knowledge on bacterial gas. The success of this ambitious meeting is reflected in the volume «Bacterial Gas» that contains valuable papers from key scientists of the above disciplines.

The book is structured into five chapters : the microbiology of methanogens (two papers), composition of bacterial/thermogenic gas (four papers), case histories (five papers) and miscellaneous (four papers) touching subjects as diverse as gas hydrates and environmental issues.

In addition some of the papers are followed by a useful record of the short discussions that followed the presentations at the conference.

The volume is preceded by a foreword from B. Durand and a listing of the Milan conference participants.

The book was published by Editions Technip in 1992 and although more than two years have elapsed between the conference and the publication, one criticism is that the typography of the volume is rather heterogenous resembling a collection of copied original manuscripts. Figures, and tables of the collected articles are therefore of variable print quality. The ref-

erence articles are also not uniform throughout the book, but follow two different principles with both numerical and alphabetic listings used (the latter being the majority). Despite this in general the papers are of acceptable clarity to allow easy reading. Certainly the volume is a valuable contribution to the present day knowledge on bacterial gas which has already found its way into the bookshelves of explorationists, and will equally be appreciated by post-graduate students of organic geochemistry.

Bernd MYCKE  
Petrofina.

Georges HENRY - *Géophysique des bassins sédimentaires*. Editions TECHNIP, Rue Ginoux 27 - F-75737 Paris Cedex 15. 1994, 445 p., Prix : 750,- FF. ISBN 2-7108-0658-4.

Dans cet ouvrage, G. Henry retrace l'évolution des techniques géophysiques d'exploration : gravimétrie, magnétométrie, méthodes tellurique, magnétotellurique, électrique et électro-magnétique. Les méthodes sismiques et plus particulièrement la sismique-réflexion sont les plus employées car elles permettent une meilleure visualisation du sous-sol.

L'ouvrage est divisé en quatre chapitres. Le fonctionnement et l'interprétation des différentes méthodes géophysiques utilisées avant la sismique-réflexion sont abordés dans le premier chapitre. Le chapitre suivant explique les différentes étapes de la sismique-réflexion : théorie de base, acquisition des données et traitement. Les développements théoriques ont été regroupés en annexe. Le troisième chapitre examine les données de la sismique-réflexion pour quatre milieux tectono-sédimentaires différents. Le dernier chapitre discute de l'avenir de cette méthode.

Cet ouvrage aborde tant le passé que le présent ou l'avenir des méthodes géophysiques. Dans les annexes, l'intéressé trouvera de multiples discussions plus approfondies sur certains propos théoriques. Les légendes accompagnant les figures sont cependant trop souvent succinctes, ce qui rend leur compréhension parfois ardue.

L. WOUTERS  
Geologica

A.B. VISTELIUS, D.N. IVANOV & M.A. ROMANOVA - *Granitoid Rock Studies and Analyses of Siberia and Mongolia - Mineral potentialities*. Theophrastos Publications S.A., 33 Theologou Str., Zographou, Athens 157 73 Greece. 1995. Hardback, 210 x 290 mm, 50 pp. text, 466 pp.tables, Price : 60.00 US\$. ISBN 960-7457-09-9.

This book is a compilation of a large number of chemical analyses of granitoid rocks from eastern Siberia (east of 100°E) and Mongolia. Most of the 4569 analyses presented here were stored in secret archives during the Soviet era at several regional geological surveys. All analyses were made under the same standard conditions, using reagents of good quality, making this compilation a reliable and unique data source for further geochemical interpretation. The tables list 11 major and minor components as oxides, and loss on ignition. A thorough effort was made to discard doubtful results e.g. when the sum of all components falls outside the range 99 to 101 %. No detailed location map is provided, but geographical coordinates precise to the minute are included for all data, as are short petrographic determinations.

The book has several subtitles: «Basic information on the mineral wealth of Siberia and Mongolia», «The scientific data that led to the opening of the mineral wealth of Siberia and Mongolia» and «Chemical composition and petrographic features of Mesozoic granitoid rocks located on the territories of Russia and Mongolia to the east of 100°E meridian». The reference to mineral wealth is a bit misleading, as no metal analyses are given in the tables, and the petrographic description of each sample is limited to a short statement. However, the text includes a short discussion of the different geological regions, subregions and magmatic belts, each with its typical intrusive rocks and ore mineralization. The age, chemical and petrographic affinities, and structural features are given.

The broad crustal structure of the whole area is also discussed, based mainly on seismic and magnetic data. An attempt is made to explain the different magmatic belts within an evolving plate tectonic framework.

Very little statistical work has been done on the raw figures, and few maps are presented. Univariate histograms were drawn. As a preparation to multivariate mapping, a quantilic code is calculated for each sample, based on Si, Ti, Al, Fe<sup>3</sup>, Fe<sup>2</sup>, Mg, Ca, Na and K oxide content (in that order), by subdividing the range of values per oxide into 7 parts. As an example, a dioritic standard rock at the basic end of the compositional range, low in Si and K content, but high in the other elements, would have a code of 177 777 771. This rough basicity index leads the authors to calculate a polynomial trend-surface, a map of which shows isolines with increasing acidity towards the ancient stable blocks, and highest basicity adjacent to the Pacific boundary zone.

A similar quantilic expression based on a subdivision in 3 equiprobability parts instead of 7 leads to a brief discussion of the most common rock classes as defined by the combination of the nine oxides; the occurrence of the seven most abundant classes is

described, along with their petrography and accompanying mineralization.

There is a lot more multivariate work that could be done on these raw data, for anybody interested in a particular aspect of magmatic geochemistry. Indeed, the short text that comes with the analyses seems to be intended as an invitation. Surely a systematic study of the chemistry of intrusive rocks, in combination with the spatial extension of different rock types, has the potential to unravel the post-Palaeozoic plate tectonic and magmatic history of this area, which has been lying above Pacific subduction zones for several hundred million years.

W. DE VOS

Belgian Geological Survey

WHATELEY, M.K.G. & SPEARS, D.A. - *European Coal Geology*. Geological Society Special Publication N° 82. Published by The Geological Society London, 1995. 344 pages, 175 ill., 21 papers, index. ISBN 1-897799-19-5. Price US\$ 100/£ 60 (members of the Geological Society: US\$48/£29).

Proceedings of the first European Coal Geology Conference, held at Leicester University, 15-17th September 1993.

Special attention is given to possible applications of sedimentology and sequence stratigraphy in deciphering the architecture of the British, or, by extension, all northwest European Coal Measures: sedimentary facies model, rationalised for recognition in borehole cores, a didactic overview of the influence of lithological and rock mechanical characteristics and sedimentary facies on longwall or opencast coal mining, sequence stratigraphy of paralic coal deposits and position of coal seams within the systems tracts, either greatly assisted by the recognition of incised valley deposits or balancing glacio-eustatic allocycles and local episodic fluvial processes in a remarkable and widely applicable synthesis. Geochemical tracking of volcanic origins of tonsteins, trace element distribution in coal macerals and minerals and use of penetrometer tests in shallow boreholes in the tectonically fractured South Wales coalfield complete the first section.

The contribution of borehole seismic methods for opencast coal mining is critically assessed, and found valid for structural reconnaissance of very small faults and old mine workings. High resolution surface seismic exploration, developed for underground longwall coal mining, is unusable in the upper 100-200 m because of reverberations and ground roll but has provided the background for new developments. Two borehole seismic methods are compared: cross-hole

and hole to surface (which could be described as reverse multi-offset vertical seismic profiling). Although both methods have their merits and proper applications, the latter is considered the most versatile and secure in actual opencast mining.

The resources, environment and energy policies section contains useful overviews on coal availability and production constraints for Greece and Czechia. Experimental monitoring of airborne dust derived from a South Wales opencast coal mine and comparison with supposedly unspoiled areas by means of four-way directional gauges revealed inherent difficulties for quantitative assessment: biological contamination is extremely important in summertime; furthermore only clay minerals seem to reflect on-site events but are difficult to differentiate. The European Community energy policy, viewed from the British coal industry, is severely attacked as it was ineffectual to enforce its own guidelines in a coherent way or to streamline divergent national energy policies: as a consequence, mine closures bear no relationship to mining performance nor to rational use of the coal reserves.

Case histories refer to coalfields in Great Britain, Belgium, Czechia, Hungary and Turkey. They include diverse subjects such as exploration-production history of the East Pennine coalfield, structural factors in open pit design in the thrustured South Wales coalfield, basic geological controls on coalbed methane resources in Great Britain, sedimentology and synsedimentary deformation of Westphalian C deposits in the Campine coalfield, palaeotopography, compaction and coal seam thicknesses in the Czech Kladno basin, uranium enrichment in a Hungarian Cretaceous coal and sulphur enrichment in Anatolian lignites.

Most papers deal with regional coal studies and evaluate the potential economic contribution of new techniques. As could be expected from a volume dominated by British Coal Measures specialists, thorough and valuable reviews of sedimentology and sequence stratigraphy make this special publication a worthy acquisition.

M. DUSAR

Belgian Geological Survey

BOYER, S. & MARI, J.L. - *Sismique et diagraphies*. Editions Technip, rue Ginoux 27 - F-75737 Paris Cedex 15. 1994, 198 p. Prix : 320,- FF. ISBN 2-7108-0674-6.

Ce livre de près de deux cents pages figures incluses, a été élaboré à partir de cours donnés à l'ENSPM. Le style le trahit immédiatement et il mérite

effectivement d'être connu des étudiants de géosciences.

L'ouvrage couvre principalement les méthodes acoustiques de sondage : diagraphie et sismique de puits. Il a pour but principal de discuter des techniques de mesure dans les sondages afin d'en utiliser le plus efficacement possible les informations géologiques dans l'interprétation de sections sismiques. La diagraphie de densité (p. 54 à 60), la pendagemétrie (p. 68 à 73) et occasionnellement les diagraphies de résistivité sont brièvement abordées dans leur apport complémentaire de l'interprétation des mesures acoustiques.

Au début de l'ouvrage, une présentation des notions générales importantes de la diagraphie en sondage (p. 15 à 23) sont expliquées. Ensuite, une discussion de la diagraphie acoustique est présentée (p. 24-53). Le texte se voulant principalement pratique, aucune discussion des bases théoriques n'est soulevée. Grâce à une bibliographie (p. 187-194) bien structurée, le lecteur pourra facilement approfondir ses connaissances. Une présentation assez limitée et fragmentaire de l'interprétation et de l'application des diagraphies (p. 60 à 76) peut quand même s'avérer être pragmatique pour le géologue. Sont passés en revue : les méthodes «quick look» pour la détermination du contact eau-hydrocarbures et de la porosité, les techniques des diagrammes croisés, le calcul de la porosité utile et de la saturation en hydrocarbures, la détermination des pendages, l'étude de la compaction, de la fracturation et de la perméabilité.

Le deuxième chapitre traite de la sismique de puits (p. 77 à 103). Le PSV (profil sismique vertical) simple, déporté et l'utilisation de la sonde à trois composantes sont discutés ; la marche à suivre du traitement des données est consignée (p. 77 à 95). Pour une meilleure compréhension de la partie technique de l'ouvrage, il aurait fallu mieux l'étoffer. Sont également expliquées de manière brève (p. 96 à 103) la détermination de l'impédance acoustique, l'analyse des ondes P et S et la détermination du coefficient de Poisson, l'atténuation des amplitudes et l'identification des zones à forte perméabilité par l'analyse des ondes Stoneley.

Le troisième chapitre (p. 105 à 120) nous explique la différence entre les temps soniques et les temps sismiques. Il présente également les moyens de caler la diagraphie sonique. Le chapitre se termine par une démonstration de calcul d'une diagraphie d'impédance et l'étude d'un sismogramme synthétique.

Quant au quatrième chapitre (p. 121 à 137), il est entièrement consacré aux sismogrammes synthétiques. Neuf de ces pages présentent uniquement des

figures. L'importance du sismogramme synthétique de type PSV est bien expliquée et l'inversion sismique est brièvement abordée.

Le chapitre suivant est consacré aux variations d'amplitudes (p. 139 à 146), à leurs causes, à l'effet AVO (amplitude versus offset) et aux indicateurs directs d'hydrocarbures.

Le livre se termine par la présentation d'études de cas (p. 147 à 186), tels que : la détermination de fractures ouvertes par diagraphie sonique, la calibration de sismique de surface, la relation d'impédance acoustique et la porosité, la détermination de l'extension d'une bulle de gaz dans un stockage souterrain, la prédiction en profondeur sous le puits et la détection de surpression, l'interprétation sismique en séries salifères et la détermination d'un modèle structural par PSV et la pendagemétrie.

N. VANDENBERGHE  
K.U.Leuven

DEGREMONT (Ed.) - *Lexique Technique de l'Eau - Water Treatment Glossary Français/Anglais, English/French, Technique et Documentation Lavoisier, Rue Lavoisier 11 - F-75384 Paris Cedex 08. 1995, 336 p., Prix : 350,- FF. ISBN 2-85206-936-9.*

Contenant, d'une part, un vocabulaire de base tiré de la neuvième édition du Mémento Technique de l'Eau de Degremont, le présent lexique s'est, d'autre part, largement enrichi de termes et expressions courantes provenant d'une littérature technique abondante dans le domaine du traitement de l'eau.

Le vocabulaire a été collecté puis vérifié au Service Traduction de Degremont (Filiale de la Lyonnaise des Eaux spécialisée dans le domaine de l'eau). Le présent lexique s'adresse aux ingénieurs, chercheurs, techniciens, enseignants, étudiants, gestionnaires, contrôleurs, etc... qui pourront ainsi disposer d'un instrument à la mesure de leurs besoins. Tous trouveront dans le Lexique technique de l'eau les équivalences entre les termes français et anglais liés au traitement des eaux résiduaires, pluviales, potables... rendant ce dictionnaire bilingue très pratique, tout en restant fiable.

**DAS SUBVARISCIKUM NORDWEST-DEUTSCHLANDS. Struktur und Lagerstättenpotential eines Vorlandbeckens. Fortschritte in der Geologie von Rheinland und Westfalen. 38:** 356 p. Krefeld. ISSN 0071-8009/ISBN 3-86029-838-0. Preis : DM 115,-.

Published by Geologisches Landesamt Nordrhein-Westfalen, Postfach 1080, D-47710 Krefeld.

The Geological Survey of Nordrheinland-Westfalen should be recommended for continuing a prestigious tradition: a new monograph on the Coal Measures to the North of the Variscan Foldbelt has been published which certainly equals or surpasses previous Fortschritte volumes in importance and utility. The present publication brings the synthesis of three research programmes - structure, reserves, hydrocarbon generation - initiated by large-scale exploration campaigns in the German hard coal basins in the aftermath of the 'oil-shocks' of the seventies. It is to hope that the socio-economic problems facing the coal industry today will not too adversely affect the continuation of research efforts on the variscan foreland.

The first contribution by G. Drozdowski and V. Wrede deals with fold and fault tectonics of the Ruhr, Aachen-Erkelenz and Ibbenbüren coal basins. The wealth of structural data derived from mining and exploration is such that a three-dimensional image for the whole Subvariscikum can be presented down to a depth of 2000 m, with predictions on deep structure. History of deposition, orogenic shortening and autochtony, vertical tectonic differentiation, spatial and temporal relation between fold and fault tectonics are analysed in detail. It is regretted that the fundamental work on salt tectonics and inversion by H.G. Rossa, published in Belgium, is ignored.

The second contribution by D. Juch and his colleagues W.F. Roos and M. Wolff deals with the assessment of the hard coal reserves in North Rhine-Westphalia and the Saar basin. A computerised mathematical and geometrical model has been developed to include all structural data and coal distribution and quality values. Coal seam continuity and thickness distribution was assessed within fault-bounded structural blocks which formed the basal units for all calculations. This allows representation of coal reserves according to depth, seam thickness, dip, volatile matter content for each block. The main advantage of this system is its versatility and utility for any future use of coal. Total coal resources amount to 465 Mrd. m<sup>3</sup> of which ca. 11 Mrd. m<sup>3</sup> have been exploited. In-situ coal reserves available for mining stand at 17.5 Mrd. m<sup>3</sup> of which about 60% occur in the Ruhr basin, 20% in the Saar basin and less than 10% in the Aachen-Erkelenz basins (compare to 3 Mrd. m<sup>3</sup> in the Campine basin, based on similar parameters).

The third contribution by A. J. Lommerzheim on the formation and migration of natural gas in the Münster basin is primarily based on studies of headspace and blender gases in the Coal Measures and overlying sediments from selected exploration boreholes. A clear distinction is made between the eastern and middle Ruhr districts, based on post-Carboniferous heating events, affecting the former and still related to actual

geothermal gradients. This study is essential for a good understanding of the coalbed methane potential of the Münster basin.

The new Fortschritte volume deserves special attention from geologists working in adjacent basins because these model studies are exemplary for the interaction between geological research and mining/hydrocarbon exploration interests. Furthermore methodology, as well as many observations and conclusions, are readily applicable in the neighbouring countries.

M. DUSAR  
Belgian Geological Survey

CHARLES OFFICER & JAKE PAGE - **TALES OF THE EARTH. Paroxysms and Perturbations of the Blue Planet.** *Oxford University Press* 1993, 226 p. ISBN 0-19-509048-9 (paperback). Price : £ 9,-.

In this book, the authors look at some of the great events in geologic history, most of them in the historic past and troublesome for humanity (possibly we should assume the dinosaur extinction as part of our collective memory), and others of humanity making trouble for nature. Each event is presented as a tale in a lively, journalistic style, for the general public, though the authors attempt to explain what caused them and what were the global environmental consequences. A very practical reference list will serve those readers looking for more information.

The book follows the logical sequence typifying all geological textbooks: first geological processes of internal planetary and cosmic origin, then external geological processes, and finally man's effect on nature. The themes are familiar for most geologists, certainly for those coming from North America or Western Europe: violent volcanic eruptions and earthquakes, flooding and sea-level changes, comets and meteor impacts, climate changes, mass extinctions and pandemics, the most famous pollution cases, the ozone hole, acid rain, the population explosion, natural resources depletion and global warming. A discussion on the pathways towards a renewed harmony between man and nature forms the appropriate end of this book. Curiously enough, the need for woman's education is its most practical and convincing recommendation.

Although each tale stands on its own and can be read by non-scientists, it is clearly the purpose of the authors to bring the geological perspective, which unites all tales, into public attention. Therefore this work is also recommended to geologists and other scientists who have to communicate with the

general public, inform the authorities or guide new generations of students about local and global environmental issues.

M. DUSAR

Belgian Geological Survey

Brian J. SKINNER & Stephen C. PORTER - **THE DYNAMIC EARTH. An Introduction to Physical Geology** - 3rd Edition, 1995. *John Wiley & Sons, New York*. 567 p. with appendices, glossary, index and bibliographic references. ISBN 0-471-59549-7 (paperback). Price £ 21.50.

This is the almost perfect geology textbook for students (of all ages), whereby the authors naturally aim at their American undergraduates. It has been conceived and written to instruct, to provide a broad insight in the mechanisms and evolution of the planet Earth. For this purpose each chapter is introduced by a short essay from a non-geological perspective, linking the theme to actual social problems; it is concluded by a another essay on resources or the environment, with summary, a list of important terms to remember and questions for review. Of course this work is lavishly illustrated, with exciting photographic material. Quantitative data are grouped in 'closer look' sections. Young students are incited to look at geology as a science of great importance to society; the role of geologists in identifying and preventing problems or providing answers to some of the great questions that upset mankind is highlighted in 'good stewardship' essays at the end. This positive attitude is further stimulated by information on geological research and career opportunities.

This book is subdivided in three parts entitled 1) the earth's materials, 2) processes that shape the earth's surface, 3) the evolving earth. It is built around four recurring themes: 1) internal and external geological processes fueled by plate tectonics, 2) environmental change with interaction between litho- hydro- bio-atmosphere, 3) mitigation of natural disasters (recent examples are cited as could be expected), and 4) human use of natural resources, where and how to find and economics. Remarkable for this kind of textbook is the increasing emphasis on oceans as decisive, but still poorly understood elements in our environment. Global responsibility is the starting point but also the end-conclusion of this unique work-document. Highly recommended !

M. DUSAR

Belgian Geological Survey

François ROURE - **PERI-TETHYAN PLATFORMS**. *Editions Technip, rue Ginoux 27 - F-75737 Paris Cedex 15. France*. 1994, 294 p. ISBN 2-7108-0679-7. Prix : 480,- FF.

Cet ouvrage fait partie des documents édités dans le cadre du programme international de recherche Péri-Téthys (1), et fait suite à une Euroconférence qui s'est tenue à Arles (France) en mars 1993. Il comprend 4 parties.

En introduction, P. Ziegler résume sous forme de schémas évolutifs la dynamique des bassins Péri-Téthysiens à l'échelle globale. Wilson analyse les relations entre le magmatisme et l'évolution des bassins dans ce même domaine.

Dans les deuxième (Deformations at Plate Boundaries) et troisième parties (Paleostress), le lecteur trouvera des synthèses géodynamiques régionales de domaines particuliers (Carpathes, Plateforme Sud Tunisienne, Sicile-Nord Afrique, Sud de la Mer du Nord, Atlas algérien...). La partie «Paleostress» reflète l'état d'avancement des connaissances en microtectonique et de l'étude des contraintes. Notamment, M.L. Zoback présente les cartes du «stress» actuel à l'échelle mondiale. F. Bergerat rappelle l'historique des études en termes de paléo-contraintes. Signalons qu'à cette fin, sont utilisés des exemples à la limite Crétacé-Tertiaire dans le Bassin de Mons. P.L. Hancock délimite l'utilisation des «joints» dans l'étude des paléo-contraintes. J. Angelier *et al.* présente les derniers développements dans l'analyse des trajectoires de contraintes, avec leur implications. Enfin, O. Lacombe *et al.* résume les utilisations possibles des macles de la calcite en terme de paléo-contraintes en domaine sédimentaire.

La dernière partie concerne les corrélations biostratigraphiques, en particulier à la limite Crétacé-Tertiaire autour de la chaîne de l'Oural (E.O. Amon & P. de Wever) et au Mésozoïque dans le domaine Péri-Téthysien (J. Thierry).

Cette édition hors série a permis aux auteurs d'exposer largement des données originales sans toutefois tomber dans des développements trop techniques.

Cet ouvrage est à conseiller à ceux, spécialistes ou non en microtectonique, qui apprécient la lecture d'études géodynamiques à l'échelle régionale, basée sur des analyses conséquentes et de longue haleine.

(1) Le projet «PériTéthys» prolonge le projet Téthys (Dercourt J., Ricou L.E. & Vrienlick, 1993, Atlas Tethys Paleoenvironmental map. Gauthier Villars, Paris, 14 maps, 307 p., 1 pl.). Les contributions présentées au cours du congrès de Arles constituent les bases de réflexion pour une bonne marche de ce nouveau programme international.

S. VANDYCKE

F.P.Mons

H. WACKERNAGEL - **Multivariate Geostatistics. An Introduction with Applications.** Springer Verlag, Berlin. 1995, 255 p. ISBN 3-540-60127-9. Price : 74,- DM.

Multivariate geostatistics gives an introduction to geostatistics with the emphasis on multivariate aspects. The material treated sprouted from lectures in postgraduate programs at the Centre de Géostatistique, Ecole des Mines de Paris, Fontainebleau. The book is intended for applied scientists, engineers and statisticians. The topics treated can be divided in five parts :

**Part A** reviews basic concepts in geostatistics such as expectation, variance, variance-covariance matrix and spatial multiple linear regression or kriging.

**Part B** forms an introduction to linear geostatistics for a single variable in the framework of random function theory. Variogram and covariance, experimental and theoretical, are introduced with the assumptions of stationarity which apply to them. The effect of support on estimation and dispersion variance is explained. Linear kriging methods are treated and their properties (smoothing, behaviour of kriging weights, spatial components) are discussed.

**Part C** presents statistical methods for describing multivariate correlation without reference to the spatial framework. These are : Principal component analysis, canonical analysis and correspondance analysis.

**Part D** is the extension of linear geostatistics (part B) to the multivariate case and multivariate analysis (part C) to the spatial case. Properties of cross variogram and cross covariance are discussed. Random function theory serves as a framework for defining two models : the intrinsic correlation model and nested multivariate model. Cokriging systems are presented to evaluate the use of auxiliary variables. The problem of kriging a complex variable is treated.

In **Part E** auxiliary variables from multivariate problems act as so-called external drift functions within non-stationary phenomena. The concept of random function of order-k is introduced.

Multivariate Geostatistics is the first comprehensive book on multivariate concepts in geostatistics. It is intended as an introduction with the emphasis on theory rather than applications. A good knowledge on geostatistical and random function theory certainly enhances the readability of the book. Some basics on linear algebra are warranted as well. The book stresses the problem of estimation, i.e. estimating the value of a phenomenon at an unsampled location. The author therefore restricts himself to linear geostatistics. Some issues on simulation, non-linear geostatistics or other types of uncertainty modelling certainly would have broadened the scope of the book. Practical examples are limited but exercises compre-

hensively illustrate the theory presented. However, an extensive reference list on various topics, applications and software should help the interested reader to find his ways through this rapidly evolving field of applied statistics.

Jef CAERS  
K.U.Leuven

G.M. ANDERSON - **Thermodynamics of natural systems.** John Wiley, Baffins Lane, Chichester, West Sussex, PO19 1UD, England. 1995, 382 p. ISBN 0-471-10943-6. Price : £ 39,95.

A good understanding of the thermodynamics of chemical reactions is a central concern for chemists, biologists... but also for environmental scientists and geologists. This book provides this basic knowledge of chemical thermodynamics which can greatly help to understand what controls the changes (reactions) taking place in natural systems.

Of course these natural systems are more complex and open than the classical thermodynamics models which are usually very simple and usually closed.

The fundamental problem addressed in this very fascinating book is to understand why the changes (in terms of chemical reactions) happen the way they do... in relation with some relative states of minimum energy. This energy is not only expressed in terms of heat but a kind of «chemical energy» must be added.

An excellent book for all the «modelers» of natural systems or for any scientist passionate by chemical reactions in our open environment !

Prof. A. DASSARGUES  
Université de Liège

Harsh K. GUPTA & Rajender K. CHADHA - **Induced Seismicity.** Birkhäuser Verlag AG, Klosterberg 23 - CH-4010 Basel, Switzerland. 1995, 220 p. ISBN 3-7643-5237-X. Price : SFr. 38.

Cet ouvrage reprend 16 articles présentés lors d'un colloque organisé à l'Université Victoria (Wellington, Nouvelle-Zélande) du 10 au 21 janvier 1994 sur le thème «Seismicité Induite».

La sismicité induite recouvre tous les tremblements de terre générés par l'activité minière, l'extraction de pétrole ou la mise en charge de barrages.

Dans ce volume, la majorité des articles concerne la sismicité induite par la présence de réservoirs depuis



des cas étudiés jusqu'à l'application du chaos déterministe.

L'intérêt de cet ouvrage réside dans la compilation d'informations et d'études sur un thème ciblé. Son défaut est de ne pas présenter une vue d'ensemble du domaine de la sismicité induite, ce qui ne le rend accessible qu'à des géologues ou géophysiciens possédant de sérieuses notions en séismologie.

D. JONGMANS  
Université de Liège

John Mc CORMICK - **The global environmental movement**. Second edition 1995. *John Wiley & Sons, Chichester (England)*. 312 + 22 p. ISBN 0-471-94940-X (paperback). Price £ 14.99.

This publication relates the growth of environmentalism as a mass movement, though very diverse in adherents, goals and attitudes, with impact on politics, law, and above all the way we look at the earth and the realisation that nature is finite and that man and biosphere are interrelated. Environmentalism as a change in human attitudes is shown to be arising as a reaction to industrialisation: the improving quality of life for growing numbers of people makes that quality of the environment is becoming a major issue.

The book is an easily readable and sympathising, though strictly technical and lucid account of the contemporary history of the environmental movement. Its progress in time, geographical extension and scope is elucidated by a rather detailed description of political milestones (e.g. the Stockholm 1972 and Rio 1992 conferences) and the analysis of that evolution within a broader context. Extensive references and a chronology of key events are completing the book.

Although this work is focussed on the anglo-saxon world it transits the national level and provides information on the rise of global action. Yet a clear message is passed to the reader: it is argued that no efficient action by individual states is anymore possible; regional and global policies are essential to further improvement of our environment.

M. DUSAR  
Belgian Geological Survey

A.E. ADAMS, W.S. MacKENZIE & C. GUILFORD - **Atlas des roches sédimentaires** (traduit de l'anglais par J.-P. Michel). *Masson Editeur, Boulevard Saint-Germain 120 - F-75281 Paris Cedex 06*. 1994, 112 p. ISBN : 2-225-84492-5. Prix : 195,- FF.

Il s'agit d'une traduction de l'ouvrage relativement connu «Atlas of sedimentary rocks under the micro-

scope», paru en 1984. Destiné à l'étudiant et à l'amateur averti, le livre se veut un manuel de laboratoire d'identification des roches sédimentaires. Il comprend trois parties : la première est consacrée aux roches détritiques terrigènes, la seconde aux roches carbonatées et la troisième aux minerais de fer, cherts, évaporites, phosphorites. Trois annexes décrivent la façon de confectionner une lame mince et une pellicule d'acétate et détaillent la coloration de Dickson. Un index complète l'ouvrage.

Il est évidemment difficile de traiter un sujet aussi vaste en une centaine de pages et les superbes photographies au format 8 X 11 cm effleurent souvent le sujet. Il s'agit bien d'une illustration de divers aspects de la pétrographie sédimentaire et non d'un guide systématique. Ceci est particulièrement vrai en ce qui concerne les constituants des calcaires, puisque les critères d'identification ne sont pas cités ou suffisamment mis en valeur. On peut regretter également l'absence de diagrammes d'estimation de l'abondance des constituants. On remarquera cependant l'illustration de phénomènes tels que la compaction, la pression-dissolution, la micritisation. En conclusion, un ouvrage richement illustré destiné plus à une première approche de la pétrographie sédimentaire qu'à sa pratique systématique.

F. BOULVAIN  
Service géologique de Belgique

P. LECOMTE - **Les sites pollués. Traitement des sols et des eaux souterraines**. *Editions Tec & Doc Lavoisier, Rue de Provigny 14 - F-94236 Cachan Cedex. France*. 1995, 198 p. ISBN 2-7430-0023-6. Prix : 250,- FF.

Ce livre propose une approche rigoureuse et organisée de la dépollution en différentes phases : le diagnostic, l'évaluation du risque, la réhabilitation du site. L'aspect décontamination fait l'objet d'une analyse approfondie assortie de plusieurs exemples. Les aspects financiers, législatifs et les problèmes d'assurance sont également traités. Cet ouvrage abondamment illustré de schémas clairs et bien réalisés s'adresse en premier lieu aux industriels en charge d'un site, aux bureaux d'études, aux responsables de l'environnement. Il constitue également une documentation de référence pour les collectivités locales et les autorités qui ont à mettre en place des mesures réglementaires.

F. BOULVAIN  
Service géologique de Belgique

J.F. GEYS - **De Geschiedenis van het Leven. Een Overzicht van de Historische Paleontologie - 6 a - Perm - Invertebraten.** *Belgische Vereniging voor Paleontologie, pla RUCA, Groenenborgerlaan 171 - 2020 Antwerpen.* Publicatie n°16, 284 p. 1996. ISBN 90-71145-11-5 ; ISSN 0772-6163. Prijs 490,- BEF.

Dit volume is het zevende vervolg in de reeks «De Geschiedenis van het Leven» waarmee Joris Geys in 1985 begonnen is, en die geleidelijk, met een ritme van een boekdeel om de twee jaar, de stratigrafische schaal opklimt. Het werk volgt het vaste stramien van de reeks: een systematisch overzicht van de grote fossielgroepen, rijkelijk geïllustreerd met aangepaste pentekeningen, en aangevuld met een reeks parenthesen waarin de auteur dieper ingaat op eigenaardige geologische of paleontologische vondsten en probleemstellingen. Ieder boekdeel is nochtans zelfstandig te gebruiken; kruisverwijzingen naar andere nummers uit dezelfde reeks zijn overigens opvallend beperkt. In vergelijking met vroeger gepubliceerde delen komen nieuwe inzichten in levenswijze, evolutie en paleogeografie duidelijk aan bod.

Het Perm lijkt op het eerste zicht weinig belangrijk qua fossielinhoud, maar wordt vooral gekenmerkt door de uitzonderlijke biologische crisis op de overgang naar het Mesozoïcum. De ware extinctiegolf op het einde van het Perm wordt uitgebreid besproken in het volgende deel van de reeks, te samen met de vertebraten en de flora van het Perm. Het werk biedt een systematische bespreking van de fossielgroepen, met oog voor het fossilisatiepotentieel, de grootschalige evolutiegeschiedenis en de ecologische relatie met andere dieren en planten, waarbij de einde-Perm crisis steeds weer tot uiting komt.

Het Perm is in onze contreien weliswaar weinig belangrijk, maar had toch wat meer aandacht kunnen krijgen. Voor de «Poudingue de Malmédy» - weliswaar zonder fossielen uit de tijd van de afzetting - worden geen referenties naar andere literatuur opgegeven.

De auteur richt zich met de reeks 'Geschiedenis van het Leven' vooral tot de ernstige amateur, alhoewel ook de professionele geoloog hieruit heel wat achtergrond informatie kan halen. De reeks is niet bedoeld als hulp bij determinatie, maar wel als fundamentele beschrijving van de globale biologische evolutie. De auteur brengt zakelijke informatie zonder veel toegevingen aan vulgarisatie, en schuwt bijvoorbeeld spectaculaire voorstellingen van de belangrijkste extinctiegolf uit de aardgeschiedenis. Enige voorkennis van de systematiek van het dierenrijk, met inbegrip van de uitgestorven groepen, is gewenst maar verder heeft de auteur gebruik van jargon tot een minimum beperkt. Dit werk bevestigt de waarde van de reeks 'Geschiedenis van het Leven'. Het is uitzonderlijk dat zulke werken in het Nederlands beschikbaar zijn.

M. DUSAR  
Belgische Geologische Dienst

R. WANG & K. AKI - **Mechanics Problems in Geodynamics - Part I.** *Birkhäuser Verlag AG, P.O. Box 133 - CH-4010 Basel.* 388 p. 1995. ISBN 3-7643-5104-7. Price : sFr 48,-.

La géodynamique, qui étudie les mouvements au sein et à la surface du globe terrestre, est une science interdisciplinaire faisant intervenir, entre autres, la géophysique, la géologie structurale et la mécanique des milieux continus.

Le livre, édité par Wang et Aki, reprend une partie des comptes rendus d'un colloque international qui s'est tenu à Pékin en 1994 sur les problèmes mécaniques en géodynamique.

Les articles couvrent des domaines très variés, depuis les oscillations libres de la terre jusqu'à la détermination des propriétés rhéologiques des roches à partir de microstructures, en passant par la modélisation de bassins d'extension ou une nouvelle approche de prédiction des tremblements de terre.

Vu la grande variété des thèmes abordés, cet ouvrage est très peu ciblé et s'apparente à une revue de géodynamique. Il intéressera essentiellement les lecteurs déjà assidus de *Journal of Geophysical Research* et de *Tectonophysics*.

D. JONGMANS  
U.Liège

R.A. DOWNING, M. PRICE & G.P. JONES - **The Hydrogeology of the Chalk of North-West Europe.** *Oxford University Press, Saxon Way West, Corby NN18 9ES, United Kingdom.* 300 p., 1993. ISBN 0-19-854285-2. Price : £ 75,-.

Cet ouvrage très complet et fort instructif a été préparé par le Comité Britannique de l'Association Internationale des Hydrogéologues avec des collègues belges, danois, français, néerlandais et suédois. Les six premiers chapitres considèrent l'aquifère crayeux du nord-ouest de l'Europe comme un tout, tandis que les six chapitres suivants décrivent les caractéristiques propres à chaque pays concerné et que les deux derniers décrivent la craie, réservoir d'hydrocarbures et les problèmes de cet aquifère en tant que source d'eau potable.

Les auteurs expliquent d'abord les conditions de formation, la structure générale et la stratigraphie du bassin à la fin du Crétacé, puis les modifications diagé-

nétiques, l'influence de la tectonique et de l'altération. Ils donnent ensuite les caractéristiques des craies, leur condition de sédimentation. Ils soulignent l'importance de l'activité bactérienne et de la formation des hard-ground. La double porosité et la double perméabilité des craies sont bien mises en évidence. L'importance de la zone non saturée sur l'infiltration et la propagation des pollutions est bien soulignée. Sont également étudiés l'impact des travaux de génie civil et les mécanismes de transports de divers polluants, tels les percolats issus des décharges.

Il m'est impossible de résumer ici les six chapitres qui reprennent, pays après pays, l'essentiel de toutes les études dont l'aquifère crayeux a été l'objet. Je ne puis qu'en recommander la lecture attentive sans oublier non plus les deux derniers chapitres où sont mis en exergue, d'une part, l'importance des craies en tant que réservoir à hydrocarbure et, d'autre part, les dangers qui menacent l'aquifère crayeux, dont l'eau est si nécessaire à tant de distributions publiques.

D. BRUMAGNE  
C.I.B.E.

#### **Vivat Mosasaurus - Themanummer over de Mosasaurus hoffmanni.**

*Natuurhistorisch Maandblad, Jaargang 84, Februari 1995. 60 p. ISSN 0028-1107. Prijs 15 NLG. Te verkrijgen op het redactie-adres: Postbus 882, NL-6200 AW Maastricht.*

Dit themanummer belicht de huidige betekenis van de *Mosasaurus hoffmanni*, of de vreselijke maashagedis, zowat het eerste fossiele reuzenreptiel dat in de wetenschappelijke belangstelling is gekomen, voor de stad Maastricht en zijn Natuurhistorisch Museum. Het toont hoe een modern museum op eigentijdse wijze wil omgaan met het verleden en heden van een brok natuur, die intussen tot het universeel cultureel erfgoed behoort. Dit laatste mag zelfs letterlijk worden

opgenomen want de eerste en meest befaamde fossielvondsten werden door de Franse revolutionairen geroofd en verblijven sindsdien definitief in Parijs. Ook latere vondsten in privé-collecties (bijv. museum Garcet te Eben-Emael) vonden op slinkse wijze, uiteraard zonder de medewerking van de vinder-eigenaar, hun weg naar het buitenland.

De stad Maastricht blijft evenwel onnoemelijk trots op de *Mosasaurus* die haar naam wereldwijd bekend heeft gemaakt en wil op zijn beurt dit dier eren met een groots kunstwerk van Ger Boosten, aangebracht als plafondschildering in de vernieuwde hal van het Natuurhistorisch Museum. De ontwikkeling van dit concept, waarin de fossiele kop en de artistieke interpretatie van het levende dier met elkaar geconfronteerd worden, komt in dit themanummer als blikvanger eerst aan bod.

De volgende bijdrage biedt een historische terugblik op de naamgeving, in het licht van een veranderend wereldbeeld en steeds verfijnder inzichten in de evolutie, met rigoureuze toepassing van de paleontologische nomenclatuur.

De Maastrichtse stadschirurgijn Hoffmann uit de achttiende eeuw geniet vandaag veel achting om zijn klare kijk op de toen bijzonder raadselachtige, zelfs trouwerende vondst uit de mergelgrotten. Het verhaal van zijn levensloop vormt het referentiekader voor de opbouw van de museumcollecties.

De *Mosasaurus* zijn tijdens het Krijt over de gehele wereld uitgezwermd. Buitenlandse onderzoekers keren graag terug naar de historische bakermat van de soort. De catalogoog van de collecties van het Natuurhistorisch Museum en recente aanwinsten wordt voorgesteld.

De originele *Mosasaurus* mag dan al in Parijs zijn laatste rustplaats hebben; in Maastricht is de *Mosasaurus* terug tot leven gekomen.

Michiel Duser  
Belgische Geologische Dienst