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# Paleocurrents and Basin Analysis

Andrew D. Miall

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## Ontogeny and Phylogeny

By Stephen Jay Gould
*The Belknap Press of Harvard University Press, Cambridge, Mass.*
*501 p., 1977.*
U.S. $18.50

Reviewed by G. E. G. Westermann
*Department of Geology,*
*McMaster University,*
*Hamilton, Ontario*
*L8S 4M1.*

Although the author denies it, this book is a courageous defence of a theory rejected by most 20th century English speaking biologists and paleontologists, i.e., the development of the individual reflects the evolution of the group. Long after the concept was discarded by British and American scientists, it was vigorously defended in Germany by the distinguished late O. H. Schindewolf, with whom I studied. A dozen years ago, I had the experience of a published attack by a well known British colleague, on the grounds that concluding the existence of recapitulation was obviously absurd. Consequently, I welcome Gould's arguments supporting the phylogenetic significance of ontogeny for their outstanding depth and conviction.

Gould is well qualified as a biologist and palaeontologist to analyse the complex subject matter at the interface of the two disciplines and to review critically the long historic and often philosophic background. In particular, his understanding and enjoyment of the extensive German writings of the *Naturphilosophen* is evident (who can forget Gould's convincing performance of Herr Professor Haeckel emotionally defending his "Law of Recapitulation" at the Denver Meeting of the Paleontological Society?). However, I suspect most readers may consider this historical review, taking up half the book, overextended; the inclusion of Freudian psychoanalysis, primary education, racism and criminal anthropology is certainly not essential to the main thesis of the book. Yet, Schindewolf's theory of "proterogenesis" linking macroevolution with ontogeny, is only briefly mentioned.

The meat of the book is found in Chapter 7. Gould sorts out the existing confused and confusing terminology by reducing De Beer's eight categories of supposed heterochrony to only two processes, i.e., ontogenetic acceleration and retardation - of either somatic or sexual development. The morphologic results of these varying relative growth rates are by no means easily distinguished. Thus ontogenetic recapitulation of phylogeny may be due to accelerated somatic development (*acceleration*) or to retarded sexual development usually with larger body size (*hypermorphosis*); *paedomorphosis* (the retention of ancestral juvenile characters by later ontogenetic stages of descendants) may result from either accelerated sexual (*progenesis*) or retarded somatic development (*neoteny*). Gould uses an ingenious "clock model" to illustrate and differentiate particular types of heterochrony for a variety of phylogenies.

In chapter 8 and 9, Gould discusses in detail the modes of paedomorphosis with reference to evolution using examples from the Recent animal world. He attempts here to explain the ecologic significance of progenesis and neoteny with the *K* and *r* selection modes.

The final chapter places humans into the proper perspective. In particular, the reproduction of an old pair of portraits of chimpanzees provides uncomfortable support that we are neotenous apes, after all. If we are neotenous, then who among us would deny the phylogenetic success of the process?

Finally, there are an epilogue, extensive additional historical notes, a large bibliography of about 900 entries, and - last but not least - a glossary and index.

This book is well set, illustrated and hard-bound, contains almost no printing errors, and above all, has an attractive price tag. It is certainly of excellent value for the private collection of any biologist and palaeontologist with broader interests; and a must for every university library.

MS received March 31, 1978

## Paleocurrents and Basin Analysis

By P. E. Potter and F. J. Pettijohn
*Second, corrected and updated edition*
*Springer Verlag, New York, 425 p., 1977.*
US $24.50

Reviewed by Andrew D. Miall
*Geological Survey of Canada*
*3303 - 33rd Street N.W.*
*Calgary, Alberta T2L 2A7*

The phrase 'paleocurrent analysis', meaning simply the study of old, or former currents, does not adequately convey an impression of what this subject has become in the last two dozen years. The primary aim of investigating paleocurrents in sedimentary rocks is to permit a reconstruction of paleoslope which, in turn, yields information regarding sediment sources and dispersal trends. However, studies of paleocurrent variance can, in addition, provide useful clues as to depositional environment and, on a local scale, variations in mean current direction can be used to reconstruct the morphology and orientation of landform elements such as shoreline bars and barriers, submarine and subaerial fans, rivers and deltas. Analyses of this type are an integral part of any sophisticated basin study if its paleogeography, depositional environments and sediment dispersal dynamics are to be properly understood and, it is fair to say, anyone nowadays who neglects this aspect of the work is simply not doing his job.

If you still need convincing, or if you want some fresh inspiration, this is the book for you. Its authors (and their students) were at the forefront in the development of the techniques of basin analysis over 20 years ago, and this book demonstrates that they are still right up there. Although little of the material used in the books is strictly their own, their grasp of the subject and the scope of their synthesis would be hard to improve on.

The first edition, published in 1963, contained a chapter on the history of paleocurrent investigations, four chapters describing, with examples and case studies, the use of the various directional elements such as fabric, crossbedding, linear features and deformational struc-

tures, a chapter on the study of sedimentary body shape and orientation, two chapters on regional dispersal patterns and basin analysis, and a closing chapter on methodology. The new edition contains all this in the identical (photocopied?) form including the original fine set of plates. What has been added is a set of complementary chapters bringing each of the original chapters up to date over the 1963-1976 period. By this method the authors made their work of updating much easier, but it does have the disadvantage that a reappraisal of the earlier material has not been carried out. The literature coverage is worldwide and, in addition to 'conventional' sedimentary rocks, mention is made of the sedimentary structures and paleocurrents of volcaniclastic strata and directional features on Mars.

This is not a textbook on basin analysis, as such, and the techniques of stratigraphic and facies analysis are not dealt with. The focus is on the detection and mapping of directional attributes in sedimentary rocks. A few criticisims could be made; for example, very little mention is made of paleohydraulics, which is becoming an important component of paleocurrent analysis in alluvial rocks. The use of paleocurrent studies in investigating the morphology and sedimentary evolution of tidal channels and of bars in fluvial channels is also an interesting development that receives little attention. Undoubtedly, other reviewers would harp on the lack of a different set of pet topics, but, overall, it is difficult to fault this book. It is well written, copiously illustrated, reasonably priced, and most emphatically recommended for advanced students and working geologists.

MS received May 8, 1978

## Stratigraphic Atlas of North and Central America

By the Exploration Department
of Shell Oil Company
*Princeton University Press, 272 p.*
*Copyright 1975, Publication date 1977.*
$50.00

Reviewed by Colin W. Stearn
*Department of Geological Sciences*
*McGill University*
*3450 University St.*
*Montreal, Quebec H3A 2A7*

About two years ago the Shell Oil Company sent a plastic-bound atlas of stratigraphic maps to Geology departments with the suggestion that the information would be useful in teaching. This atlas has now been issued in a hard-cover edition by the Princeton University Press. These maps are the latest in a distinguished line of stratigraphic compilations that goes back to the paleogeographic maps compiled by Charles Schuchert at the beginning of this century. Notable members of the lineage have been the lithofacies maps of Sloss, Dapples, and Krumbein, the paleotectonic maps of the Permian, Triassic and Jurassic Systems by the U.S. Geological Survey, the Western Canada atlas of the Alberta Society of Petroleum Geologists, and the stratigraphic atlas of the Rocky Mountain Association of Geologists. The Shell Atlas is a valuable contribution to the compilation of recent stratigraphic knowledge and the company is to be congratulated for making the summary, prepared for the orientation of their own geologists, available to the whole geological community.

Each map covers the whole of North America: they are drawn on a common base. They were compiled under the direction of T.D. Cook and A. W. Bally from the unpublished files of the company and from the stratigraphic literature. They were drawn over the period from 1968 to 1974 and each is dated to indicate the state of knowledge that it represents. The oldest maps, those of the Devonian System, are thus now 10 years old. The map coverage is somewhat uneven. Although there are facies maps for the whole of some systems, such as the Permian and Pennsylvanian; there are none for others, such as the Cambrian and Ordovician. In all the atlas contains 45 lithofacies maps, 18 age of the zero edge maps, one worm's eye map, 12 paleogeological (strata underlying) maps, outcrop maps for all the systems except the Devonian, 47 isopach maps, 32 hydrocarbon maps, 17 maps of radiometric ages, one intrusive outcrops map, and one redbeds map. Simple stratigraphic columns and regional cross sections are keyed to the maps by numbers. In addition the maps are annotated to draw the attention of the reader to uncertainties in the data and are accompanied by lists of references. The information on the maps is largely from the platform areas, coastal plains and continental shelves and facies boundaries are not generally extended into the Cordilleran and Appalachian mountain belts. The maps are printed without colour and there are some that have small areas of similar patterns which would have been improved by the use of at least one colour or by a change in scale of the base map. It is not clear to the reviewer what stratigraphic information is given by the radiometric age maps. A key shows the nature of the rock on which the analysis was made and the method used but logical conclusions cannot be drawn from such dates without further information. As an example, the Triassic map includes a date on volcanic rocks from central Quebec which might, without further knowledge, be interpreted as a record of a tectonic event. In fact, the date is related to the Manicouagan impact structure. Unfortunately also, such ages have a wide range of reliability as well as of significance, and the reader needs to be assured that a critical evaluation of each has been made by the map makers.

Most of the maps are clearly drawn and printed. In some of the maps at the beginning of the atlas the joining of zipatone patterns is obvious and the inking of the patterns is uneven but these problems seem to have been cleared up by the late Paleozoic. A few anomalies can be noted such as the appearance of the label "Antler Orogenic Belt" on a middle Permian map whereas the stratigraphic effects of this uplift date from the Mississippian Period, the inconsistencies in reference numbers on the radiometric maps, and the spelling of Plegmatites on the first map. I