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Book Reviews

Geodynamic Map of Gondwana Supercontinent Assembly

Edited by *Raphael Unrug*
Council for Geoscience, Pretoria, South Africa and Bureau de Recherches Géologiques et Minières, Orléans, France, (1996). 4 sheets. $50.

The Geodynamic Map of Gondwana Supercontinent Assembly was compiled and produced by the International Geological Correlation Programme Project 288: Gondwanaland Sutures and Fold Belts (1990–96). The main aim of Project 288 was to improve our understanding of Gondwana assembly and this map is the major output of the project. The map, which is published at a scale of 1:10 000 000 on four separate sheets, involved 69 contributors from 39 different institutes. To undertake and complete a project of this scale and complexity is a remarkable achievement and the editor and map project manager deserves to be congratulated for publishing the map at the end of the IGCP project. The project was undertaken at a time of dramatic change in understanding of pre-Gondwana reconstructions, following the publication of the SWEAT hypothesis by Professor Moores (University of California, USA) in 1991, linking South West US and East Antarctica in a Cambrian supercontinent. Ideas evolved very rapidly during the subsequent few years which must have made life very difficult for the compilers of this map. It is a pity that the map had to be produced on four separate sheets of paper but I suspect that this is a production problem.

I was initially puzzled as to exactly what the map was portraying and what the map was trying to achieve. I found the title confusing and could not understand how, what appeared to be a tectonic map of Gondwana, could address the issue of geodynamic assembly. I gave up and decided to read the *Methodology* section which includes, amongst other things, a section on the *Objectives of the map* and *Map setup and colour scheme*. The script did not help much as it is full of phrases that are not easy to understand e.g. "It (the map) presents a synthesis of the accretion of Gondwanaland". "The supercontinent assembly is reconstructed by geodynamic interpretation.....". Little wiser, I returned to the map and it was not until I had spent some time studying the map and legend that I began to understand fully what the map was trying to do. The map includes a complex array of tectonic symbols, but the key to understanding it is to appreciate that supercontinent-related units have been divided into four chronology-based, colour-coded, sub-divisions:

1. Pre-Mesoproterozoic Cratons,
2. rocks formed during the assembly of the Mesoproterozoic continent of Rodinia,
3. rocks formed during Gondwana assembly and
4. post-assembly cratonic cover and peripheral or intracontinental mobile belts.

Having established the philosophy behind the map, I immediately proceeded to see how rocks that are well known to me have been portrayed. "Shock, horror", with the exception of the Ellsworth-Whitmore mountains, West Antarctica, Patagonia and New Zealand do not exist on the map. Surely the greater part of West Antarctica and some of New Zealand were around in Gondwana times? The omission is surprising considering the expertise of some of the authors of the map. I suppose leaving them out avoided the difficult and controversial problem of deciding how to arrange the West Antarctic crustal blocks within Gondwana. In the absence of West Antarctica, my eyes focussed on what I knew to be the Falkland Islands. Unfortunately, they are not labelled but I was pleased, in view of modern ideas, to see the islands rotated and positioned off southeast Africa. However, if I am interpreting the colour and symbols correctly, they indicate late Palaeozoic pre-orogenic and syn-orogenic mafic volcanic rocks instead of the well-known Palaeozoic platform cover or intracratonic basin fill sequences. This is not typical of the rest of the map but it is disappointing to see such errors on a map compiled by an international group. There are minor editorial errors in the key (e.g. pre-orogenic and anorogenic mafic volcanic complexes have the same symbol) and it is annoying to see Gondwana and Gondwanaland used together in the same publication.

Despite the above criticisms, if one stands back from the map and gets away from local detail, the true value of the map becomes apparent. It is immediately obvious where the cratonic building blocks of Gondwana are located and which mobile belts were active during amalgamation of Rodinia and/or Gondwana, going some way towards justifying the term, dynamic, in the title for the map. Another interesting observation, that is apparent from this map, is the poor correlation of different geological units from one present-day continent to another when Gondwana is reconstructed. I am not sure of the reason for this as the reconstruction is based on a good seafloor spreading record and continental fit. This paucity of correlation across present-day oceans may indicate the complex nature of the Mesozoic rifts and support earlier supercontinent cycles of opening and closing. The inset maps are useful and bring in the dynamic aspect of the map. They summarize current views on how the continents of Rodinia and Gondwana evolved through time.

In conclusion, this map represents a tremendous achievement for an IGCP project involving scientists from 11 different

countries. For those that manage to join successfully all four sheets together, the map will form a poster that will undoubedly result in stimulating discussion and debate, and lead to new research proposals, and a better understanding of Gondwana geodynamics.

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Late Glacial and Postglacial Environmental Changes

Edited by *I.P. Martini*
Oxford University Press, Oxford (1997).
343 pages. £49.50. ISBN 0 19 508541 8.

This volume brings together a series of well-written articles having a common theme that focuses on environmental and climatic phenomena related to the transitional phases at the end of glacial cycles. The latter are either post-glacial or interglacial episodes. It is essentially a North American view, but specialists from Europe, South Africa, South America and Australia give a well-rounded coverage of the Southern Hemisphere, and the mix allows a global perspective in time and space. Reviews of this type are often an ill-collated mixture of research papers in disguise, but here Martini has persuaded his colleagues to produce comprehensive reviews that obviate the necessity for extensive background reading to gain a good overview of the subject matter. In addition, there are authoritative articles on processes related to high latitude palaeoenvironments: weathering, organic-rich sediments, and sediment deformation and redistribution. Finally, as a reminder to earth scientists that we need to look at one of the cornerstones of our science that appears to be crumbling, uniformitarianists are treated to an exposé of glacially-induced megafloods.

There are shortcomings in the book, and these include the following. The lack of a serious editorial overview of what the articles teach us for predicting future climates from our knowledge of the past; the lack of a comprehensive index that pays more than lip service to processes and ideas (the one supplied is essentially a geographical listing), and a relatively small number of photographic illustrations that are little more than enlarged black and white postage stamps. Despite these criticisms, it is a good book and I recommend it to earth scientists with an interest in high latitude palaeoenvironments, and those who wish to enter the "climate change" debate with a good grounding in what earth history may be able to teach us about post-glacial scenarios.

Finally, to pose the statutory, politically-correct question, is the book relevant? Given that the Editor in his, albeit inadequate, summary leads with his chin to declare that "in spite of human activities, a new glaciation is more likely (in the future) than warm and arid conditions", are we presented with the type of evidence to support such an important assertion?

Earth scientists need no reminding that Climate Change is a current obsession with politicians and "environmentally-concerned of Woking". When asked if I believe if "climate change" is taking place, I usually retort "I hope so". Heresy? No, if climate changes were not taking place, then most of what I have learnt as a geologist would have proven to be wrong. Under the natural laws that control the climate of this planet, it must, by definition, constantly change. What, of course, the current concern is actually all about, is what influence, if any, human activity has had on the current direction of climate change?

To be able to consider that question, we must look at the phenomenon in perspective. The present cryosphere, which encompasses large areas of both polar regions, began to form in Antarctica in latest Eocene/earliest Oligocene time, and appears to have fluctuated in size several times. Only during the last ~2 Ma has there been an appreciable cryosphere in the both polar regions. The latter is the "Ice Age" of popular journalism. But cryospheres are not unusual in Earth history, and extensive glacial periods are known to have occurred during the Carboniferous-Permian (310–270 Ma), the Ordovician (~450 Ma), and several times during the Pre-Cambrian (>550 Ma). The Earth is currently in an interglacial episode, and to discuss sensibly whether the climate will revert to a new glacial (in other words follow a natural, predictable pattern), or lurch in an anthropogenically-triggered direction, it is imperative to know what has occurred in the past. Once we understand what signals to look for, we will have bench-marks against which to interpret our modern datasets. Consequently, studies of the patterns of previous environmental changes in inter-glacial and post-glacial periods have a special relevance for those genuinely interested in modern climate change.

One of the strengths of Martini's *Late Glacial and Postglacial Environmental Changes* is that it looks at examples from all, except the Lower Palaeozoic, episodes. Consequently, the book is potentially a valuable contribution, not only for its intrinsic scientific worth, but also for use in the topical debates that engage so much of our political leaders' time. Whether the Editor's bold conclusion that insufficient change will be wrought by mankind to the chemistry of the oceans and atmosphere to deflect the Earth from another glacial episode, is one that only future generations will be able to answer unequivocally.

R.V. DINGLE