

Plate Tectonics - Assessments and Reassessments

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Tectonics and Sedimentation

Edited by William R. Dickinson
*Society of Economic Paleontologists
 and Mineralogists*
Special Publication No. 22, 204 p. 1974.
 AAPG, SEPM members \$9.00;
 Non-members \$11.00.

Reviewed by Paul E. Schenk
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Buy this book! Bill Dickinson selected eight regional summaries from a 1973 Amer. Assoc. Petroleum Geologist symposium. He tried to present plate-tectonic applications based on rock, rather than those based on paper which characterize early stages of the "revolution".

Dickinson's excellent review/overview suggests terminology useful under the new theory. Especially worthwhile is his provoking summary of basin evolution.

To an Appalachian geologist, the next three papers give a convincing, lucid, well-illustrated, evolution of the American West during the Paleozoic. Outstanding is Stewart and Poole's account of the Late Precambrian to Late Devonian, passive continental margin. Poole then introduces the mammoth Antler flysch (Late Devonian through Mississippian) that apparently runs from Mexico into the Yukon. Bissell dries out the miogeocline with late Paleozoic - early Mesozoic basin-fill.

Cratons the world over are gloriously assaulted by Sloss and Speed. Sequences are up-dated, complicated, and hooked to plate tectonics. Inflation and subsequent voiding of sub-cratonic, hot-fluid, bladders cause alternate emergence and flooding of continents - so much for phlegmatic cratons! I like this paper!

Bob Morris attempts a plate-tectonic reconstruction for the Ouachita fold belt based on a wealth of data. He even discovers Llandoria!

The next two papers try analyzing debris (molasse) from mountains to read the tectonic activity of these sources. Eisbacher, Carrigy, and Campbell take on the Mesozoic and Cenozoic of the entire Canadian Cordillera, whereas

Anderson and Picard plunge into sedimentologic detail of the latest Eocene in the Uinta basin of Utah. Both papers differentiate drainage patterns and find two episodes of tectonic uplift.

Finally, John Crowell builds deep basin by dominantly horizontal slip along sinusoidal and rectilinear faults of the California transform zone. Because Nouveau Maroc (Nouvelle Ecosse) has the Paleozoic San Andreas, Crowell's models illuminate in our fog!

We should congratulate Bill Dickinson on his collection, editing and idealism. In these days, the extensive references alone are worth the price.

MS received August 25, 1975.

Plate Tectonics - Assessments and Reassessments

Edited by Charles F. Kahle
*American Association of Petroleum
 Geologists, Memoir 23, 514 p. 1974.*
 AAPG and SEPM Members \$32.00,
 Others \$40.00.

Reviewed by H. A. K. Charlesworth
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Although aware of the dangers of preconceived ideas, most geoscientists probably maintain that without a conceptual framework their studies are likely to become routine and unproductive. Probably, therefore, few regret the general acceptance of the principle of plate tectonics whose value in the past decade has been inestimable. The objective of this *Memoir*, which stems from the symposium "Seafloor spreading - some different viewpoints" held at Bowling Green University in 1971, is to displace the principle from its position of supremacy and reduce it to being but one of several working hypotheses.

The first introductory paper, transcribed by A. A. Meyerhoff from a tape-recording of an "unscripted and over-illustrated talk" by P. J. Wyllie, is incomplete, in the second, G. A. Davis and others attempt to show that geologists have known about plate tectonics for decades. Of the 13 major papers opposing the principle of plate tectonics, the three most passionate, making up a quarter of the *Memoir*, are by A. A. and H. A. Meyerhoff who assemble data galore to claim - 1) all plate tectonic models contain serious errors, 2) the linear magnetic anomalies of ocean basins are Precambrian (*sic*), 3) most of the Atlantic Ocean north of latitude 62°N is underlain by continental crust. J. C. Maxwell lists 35 observations and features apparently not predicted by the principle of plate tectonics. Two papers by P. S. Wesson examine some problems concerning mechanisms of plate movement. One conclusion, "accept seafloor spreading, but not relative movement of the continents" will please supporters of an expanding earth; another, "plate tectonics and

convection may be implausible", will excite no one. H. Jeffries uses the modified Lomnitz law to invalidate the notion of mantle convection and thus the principle of plate tectonics. After a swipe or two at plate tectonics, V. V. Belousov expounds the virtues of primary vertical tectonics. L. S. Dillon finds the principle of plate tectonics inadequate and proposes that volcanism can explain all.

A. J. Boucot finds that early Paleozoic paleobiogeography, lithofacies and structures do not support plate tectonic models, and K. M. Khudoley concludes that neither continental drift, polar wandering nor expansion can explain the distribution of Mesozoic carbonates and ammonoids. C. J. Smiley considers that the distribution of fossil plants conforms to the continents always having been in approximately their present positions, and C. Teichert judges the distribution and composition of marine sedimentary rocks from western Australia, southern Africa and Antarctica to be inconsistent with the hypothesis of Gondwanaland.

Four major papers accept the principle of plate tectonics, although D. W. Scholl and M. S. Marlow find the absence of significant compressive deformation beneath the outer walls of oceanic trenches difficult to explain. L. de Loczy relates synchronous diastrophic events in South America and Africa to phases of seafloor spreading, and M. H. Salisbury examines the evidence for aseismic movement along fracture-zones beyond transform faults. R. C. Bostrom and others conclude that tidal forces may explain the movement of lithospheric plates. The *Memoir* is completed by four short notes.

An unfortunate feature of the *Memoir* is its repetitiveness: too often the same argument occurs in more than one paper. Its main fault, however, lies in many authors writing as if the principle of plate tectonics could not possibly be valid. It is this lack of objectivity, more than anything else, which detracts from the effectiveness of the *Memoir*.

MS received June 3, 1975.

The Geology of Continental Margins

Edited by C. A. Burk and C. L. Drake
Springer-Verlag, New York,
 1009 p., 1974.
 \$34.80.

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In my view this is probably the most important geological book of this decade. Its scope, extent and depth of insight is such that no professional geologist can afford to do without access to its thousand pages and some 71 constituent papers. The compendium was produced in the wake of a Penrose Conference which has clearly been successful and fruitful. The volume has been beautifully printed and handsomely produced. Illustrations are clear and there are several fold outs. The subject matter has been divided into 13 sections of which the first and the last by the editors review the geological significance and the perspectives of the margins. Section II sets out the Atlantic and the Pacific types by B. C. Heezen and R. L. Fisher and XII by L. G. Weeks and M. J. Cruickshank discusses the resources. The other nine sections deal with the following topics: III - Transition from continent to ocean; IV - Recent sedimentation; V - Deformation at continental margins; VI - Atlantic Region, VII - Pacific Region; VIII - Indian Ocean Region; IX - Selected small oceans. X - Ancient continental margins; XI - Igneous activity and ancient margins. It is true that metamorphism is included with the igneous activity, but even a petrological purist may disregard this *faux pas* in the context of the overall and clean distinction of the book.

In reading it through it is difficult to select any part or even pages that one assumes to be better than the rest. It is most impressive throughout how up to date all the contributions are. For instance the paper on the "Continental Margins of Galicia - Portugal and Bay of Biscay" by L. Montadert, E. Winnock, J. R. Deltiel and G. Grau has 12 references to 1973 - 1974, while the paper by D. E. Hayes on the Continental Margin of

West South America has 13 references to 1973 - 1974. Thus modern notions are summarized and analyzed in the context of large number of contributions.

The scope again is most impressive. The very first unnumbered map of the world at the beginning of the book shows the coverage of the margins attempted in the volume. The only conspicuous gaps are in the Soviet Arctic, Western Equatorial Africa, a part of Indonesia and Antarctica. Considering how extensive the continental shelves are, this is a very considerable achievement. It is also perhaps significant that side by side with a large number of North American geologists, geophysicists and oceanographers there are many contributors from Europe, Latin America and Australasia. The choice of many contributors from industry probably has helped in making the volume many sided and interesting.

Of the systematic section, that dealing with the Deformation at Continental Margins is probably particularly useful since it discusses the deep structure of continental shelves in detail; and most usefully the paper by Robert E. Sheridan, in which he reconstructs the Atlantic Continental Margin of North America, is also very well treated. One could go like this for a long time and the tendency is to go from one important topic to another and then to return back again.

The interests of the editors have led to a treatment which combines geology and geophysics, sedimentation and tectonics. After this book it would be much easier to understand and interpret ancient rocks and structures. Much of the information is that gathered by industrial companies and their presentation now leads one to the conclusion that contributions of petroleum companies are both useful and extensive. Despite its expense the book is a must with anyone who wants to understand modern geology.

MS received June 2, 1975.