LITERATURE REVIEWS

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CHALLENGING THE CREED: DOUBTS ABOUT PLATE TECTONICS?

NEW CONCEPTS IN GLOBAL TECTONICS. S. Chatterjee and N. Hotton, editors. 1992. Lubbock, TX: Texas Tech University Press. 449 p. Cloth, $65.

Reviewed by L. James Gibson, Director, Geoscience Research Institute

The theory of plate tectonics is now so widely accepted that it may come as a surprise to discover that some scientists remain unconvinced. Several of those scientists have produced a book explaining their concerns. The book is a compilation of 23 papers, most of which are critical of plate tectonics theory, although all the authors accept the premise that Earth's surface has a long, dynamic history. Alternative models favored by various authors include a "rapidly" expanding Earth, a "slowly" expanding Earth, a contracting Earth, and a model called "surge tectonics."

Several criticisms of sea-floor spreading theory are presented. Probably the most significant is the claim that granitic material is found in the ocean floor not far from the Atlantic Ridge. If the examples are valid, this would seem to be fatal to the standard interpretation of sea-floor spreading. However, one would want to be certain the continental rocks reported from along the Atlantic ridge were *in situ*, rather than transported from the continents. The strongest claim seems to be "Bald Mountain," supposedly 13 km across, near the Azores, which is close to the ridge. The presence of autochthonous continental material here of would seem to require a change in the standard interpretation of plate tectonics.

Questions are also raised about magnetic properties of ocean-floor rocks. The nature of magnetism seems related to other phenomena. For example, normal magnetic polarity seems associated with high heat flow, hot-spot volcanism, fast sea-floor spreading, and rapid rates of subsidence of cratonic basins. Volcanic quiescence seems correlated with reverse magnetic fields, yet while most of the Hawaiian-Emperor chain was formed during normal polarity, reverse polarity is considered to have occupied an equal amount of time during their formation. Another criticism is that intraplate activity is not explained by plate tectonics, a fact that is already well-known. Examples include: formation of intracratonic basins; midcontinental earthquakes, such as the New Madrid quake; seismicity of Ninety-East Ridge; and activity on the floor of the Indian plate.

The mechanism driving plate movement has never been satisfactorily determined. The criticism here is that ridge push seems to be more important than subduction pull. For example, subduction pull cannot explain how continental collision of India with Asia could result in formation of the Himalayas. Compression, rather than tension, also seems to predominate in Australia and between it and Tasmania. On the other hand, the Tibetan Plateau seems under tension rather than compression.

Certain stratigraphic levels seem to be characterized by similar effects worldwide. Several examples are given: every Tithonian (uppermost Jurassic) to Eocene foldbelt has an angular unconformity between the middle part of the Lower Eocene and the middle part of the Upper Eocene; a "bonarelli anoxic level" is present in the Cenomanian-Turonian (lower Upper Cretaceous) in mid-ocean plateaus of the Pacific Basin, the deep Atlantic Ocean, cratonic interior seaways of North America and Europe, African marginal embayments, and the Tethyan margins; worldwide occurrences of crustal shortening during Aptian-Albian (uppermost Lower Cretaceous); inversion of the direction of tilting at nearly all passive margins during the Aptian; large-scale Alpine-type orogeny and crustal shortening and a change in stress patterns in Middle to Upper Eocene; a maximum in the abundance of depositional hiatuses occurred in the Upper Miocene of all ocean basins except the Indian Ocean. These global effects suggest global causes. Episodes of world-wide crustal activity imply global catastrophism, not slow movement of continents. The most plausible source of the

energy required for global crustal activity seems to be extraterrestrial impacts. A near fly-by of a large object might probably perturb Earth's rotation sufficiently to cause global crustal activity.

The opinions of the authors of this book are undoubtedly outside the mainstream of current thinking, and some of the arguments presented are not persuasive. However, the book makes for stimulating reading, and performs the very useful function of reminding us that theories may appear to be well-established, yet may have significant shortcomings.