

# ***Geological Evolution of the Red Sea***

by **Robert G. Coleman**, published on August 26, 1993, ISBN 0-19-507048-8, book price \$59.95

## **Review by Christopher G. Kendall**

This slim volume is designed to provide a starting point for earth scientists interested in the geology of the Red Sea and for specialists who need a comprehensive survey of the Red Sea's geology. As Coleman recognized, it is difficult to synthesize the geology around and under of this sea since so many different countries border it but he has successfully managed to compile information from the various geological surveys, oceanographic studies, and the results of petroleum exploration for the Gulf of Suez and Red Sea.

The book is broken down into eight chapters. These deal with geomorphology, stratigraphy, volcanic history, age relationships, structure, geophysical outline, plate tectonics, and economic aspects of the geology of the Red Sea. The book begins with a brief introduction which explains the data sources that the author used and he lists his references at the back of the book, providing a good starting point for studies of the area for the first time.

The first chapter deals with geomorphology of the area, focusing on the shape of the Red Sea basin describing shelf segments of the Red Sea, the central trough and the occurrence of extensive subaerial lateral scarps both on the Saudi Arabian and western side of the Red Sea. There is a short description of the various islands found in the coastal waters and a very brief paragraph on the coral reefs.

The chapter on the stratigraphy encompasses the Precambrian through Quaternary sediments of the area, providing correlation charts for both the upper Cretaceous and Quaternary and describing the stratigraphy of the various volcanic episodes that the region has seen. Essentially the chapter shows that most of the sedimentary fill of the present Red Sea is related to the early Miocene development of the present Red Sea depositional basin. Prior to this Miocene event, Paleozoic and Mesozoic sedimentation trends show little evidence of the present linear structure of the Red Sea suggesting the stratigraphic relationships shown by the post-rift sediments do not support the existence of a Nubian Arabian dome prior to rifting. Coleman also indicates that the Miocene evaporite deposits of the Red Sea are a probably equivalent to those of Mediterranean Messinian, suggesting that the Mediterranean may have extended into the Red Sea at this time.

Next is the most comprehensive of the chapters in the book which deals with the volcanic history of the area. It catalogues the various volcanic events that occurred in the Red Sea area and illustrates these with a number of beautiful photographs, mostly taken in Saudi Arabia. The chapter also discusses the petrogenesis of some of lavas, illustrating their history with phase diagrams. The chapter ends with a very nice list of constraints provided by the history at these volcanic rocks, and is followed by a chapter on the age relationships of the volcanic events which occurred in the Red Sea.

Next is a chapter on Red Sea structure. This focuses on its different models for crustal extension in the area and the relationship of these models to various structural lineaments and trends which occur in the area. The author points out the Precambrian basement is highly metamorphosed and has been plastically deformed making it difficult to establish its stratigraphy, and the timing of faulting or folding, etc.

Next is a chapter describing the Geophysical data available for the area. This includes magnetic, gravity and seismic reflection character. Also featured are seismic refraction character, the seismic tomography of the Red Sea region, a discussion of heat flow and the existence of a plume in the Afar area. Each topic is illustrated by at least one map or cross-section showing, for instance, magnetic anomaly profiles with magnetic striping in the Red Sea, Bouguer gravity anomaly maps, and the use of seismic refraction to unravel the relationship between the crust and the mantle in the area. The problem here is that the hot mantle is so close to the surface that it is difficult to infer the existence of the different rock types etc.

Next is a chapter on Red Sea Plate Tectonics including the discussion of kinematics, early rifting, syn-rift events and sea-floor spreading. This is followed by a final chapter on economic aspects of the Red Sea including the discussion of hot brines and heavy metal deposits, potential for petroleum in the Gulf of Suez and around the margins of the Red Sea.

This book incorporates both ancient and modern geological data for the area, tending to provide an overview for the geology rather than representing a complete synthesis. It is very clear that the book is intended to be a source book for geological studies of the area rather than providing in-depth information about the different topics touched on by the author. Probably the best and most complete chapter in the book is that on the volcanic history of the area, representing, I believe, the focus of Bob Coleman's interests. This is a nice book to own, but may disappoint you if you are expecting a huge compendium. However it is an extremely useful book for those of you who have interest in the Red Sea, in the initial spreading history of the Red Sea, and the timing and emplacement of volcanics associated with this latter event.

This book is professionally put together, well illustrated and clearly written.

Sea is the book "Geologic Evolution of the Red Sea" by Coleman (1993). The chapter will then move to discussions. The Red Sea began in earnest as a cooperative program between the US Geological Survey and the Kingdom of Saudi Arabia, that resulted in coverage and integration of data from all of the Arabian Peninsula (USGS-Arabian American Oil Company). The Red Sea Rift is a spreading center between two tectonic plates, the African Plate and the Arabian Plate. It extends from the Dead Sea Transform fault system, and ends at an intersection with the Aden Ridge and the East African Rift, forming the Afar Triple Junction in the Afar Depression of the Horn of Africa. The Red Sea Rift was formed by the divergence between the African Plate and the Arabian Plate. The rift transitioned from a continental rift to an oceanic rift. Magnetic anomalies suggest