

Preface

In the late 1960's, Wegener's theory of continental drift, originally conceived fifty years earlier, was merged with the theory of plate tectonics and the concepts gained global acceptance among geoscientists. For the first time, a unifying concept, plate tectonics, could reconcile and unify all phenomena in geoscience into a common synthesis. The basic tenants have not changed since the 1960's, although many corrections and refinements have been added regarding questions of detail. The impact of the theory of plate tectonics cannot be overestimated – its importance to geoscience is as basic as Darwin's theory of evolution is to the biological sciences.

Earth is subject to steady change. This can impressively be realized in volcanic bursts and earthquakes around the Pacific Ocean or in the grandeur of young mountain ranges. Whilst new parts of plates are created along the mid-ocean ridges, older parts of plates disappear in subduction zones. Mountain chains arise from the collisions of plates. These dynamic processes are driven by the heat that is released from the interior of the Earth; this is what keeps the dynamo running. Continental drift, mountain building, volcanism, earthquakes, and in consequence of quakes, sea waves like the devastating tsunami of 26th December 2004 in the Indian Ocean – all this is the expression of the dynamics of the Earth.

This book presents an introduction in the wide field of plate tectonics and is dedicated to a broad audience interested in natural sciences, and students and professionals in geosciences and related subjects. Expertise in tectonics is not a pre-condition; the technical terms and geological processes are explained and reviewed in adequate detail. Many terms are defined in the glossary at the end of the book and a keyword index enables quick location of topics and terms in the text. Figures at the inside front-end and back-end covers present concise overviews of the geologic timescale and critical events in Earth history as well as the classification of magmatic and metamorphic rocks. More than 200 references enable the studious reader to gain deeper insight into special topics.

The book begins with an historical introduction concerning early ideas of continental drift and Earth

dynamics that leads into discussion and consideration of plate motions and geometry. This is followed by several chapters that define, describe in detail, and illustrate the various features, processes, and settings that comprise the plate tectonic realm: graben structures, passive continental margins, ocean basins, mid-ocean ridges, subduction zones, and transform faults. The remaining chapters deal with mountain-building processes as a consequence of plate tectonics and the collision of terranes and large continents. These chapters illuminate plate tectonic processes from the early history of the Earth to the present. We examine how plate tectonics played a role in the construction of ancient Archean continents and then built large volumes of Proterozoic crust via “modern” plate-tectonic processes. Following the late Proterozoic break-up of the supercontinent Rodinia, we follow the plate tectonic events that generated older and deeply eroded Paleozoic mountains and the formation of Pangaea to the more recent Mesozoic and Cenozoic mountains that remain the pinnacles of our modern planet. Examples from across the Earth are presented, including the young and lofty mountain ranges of the Himalayas, the Alps, and the North American Cordilleras. We relate the concepts, processes, and examples from the earlier chapters of the book to the plate-tectonic evolution discussed in the latter part of the book. In this way the book not only describes the plate tectonic phenomena, but also focuses on the processes behind them and how they have worked in concert to produce the present plate configuration. Throughout the book, we strive to communicate to the reader an understanding that the Earth is a body in constant motion and change – a tectonic machine.

The present edition has evolved from an earlier German edition, *Plattentektonik* (Wissenschaftliche Buchgesellschaft, Darmstadt) by Wolfgang Frisch and Martin Meschede (2005). Although largely a translation of the German edition, it also contains a number of new contributions by Ron Blakey, who especially enriched the text with geological examples from North America and upgraded the English text from an earlier translation.

Wolfgang Frisch, Ron Blakey, and Martin Meschede
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Plate Tectonics

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