

Preface

This book attempts to collect the information that has been gathered from the literature survey during the preparation of a doctoral thesis and constitutes the theoretical background for it.

Plumes are hot, buoyant upwellings from the mantle that reach the base of the lithosphere, producing regions of excess volcanism on the surface, known as hot spots. The presence of a plume is debated hotly in the literature. But a hot spot is an unambiguous feature on the surface of the Earth. In this book, we have tried to describe the observable features on the crust that has been ascribed due to the presence of a plume. The surface elevations surrounding a hot spot have been explained by the presence of a plume head below the lithosphere. It results in a broad swell and uplift of the crust above the plume head, with a moat-like depression surrounding the erupting volcanoes. As the lithospheric plate moves away, it leaves a trail of extinct volcanoes and a distinctive stacking pattern of sediments in the moats around the volcanoes. These surface uplifts are of two types: a temporary dynamic uplift, which disappears when the plume-related thermal anomaly dissipates, and a permanent uplift due to crustal underplating from the plume magmatism. There are different methods to identify these uplifts and estimate their magnitude, both in the case of present day, or in the case of geological past.

The chapters in the book present a brief synopsis of the current academic understanding of the plume hypothesis, its surface manifestations, and shortcomings.

Chapter 1 prepares the background parameters for plume emplacement. It deals with the elastic properties of the lithosphere and estimation of the elastic thickness of the crust.

Chapter 2 introduces the plume hypothesis, discusses the major plume types, and briefly touched upon its effect on the lithosphere. It would make the reader conversant with the basic characteristic of a mantle plume.

Chapters 3 and 4 focus on, respectively, the dynamic and permanent topography produced by an impinging plume head below the lithosphere. Estimation of the uplifts from subsidence analysis is also discussed here.

Chapter 5 discusses the thermal effects of a plume head, thermal uplift, and interactions between a mid-oceanic ridge and a plume head.

Chapter 6 describes the geomorphic features of eruption centers, hotspot morphology, flux variation, and hydrothermal circulation in a hot spot, flexure around the hotspot track, and sedimentation in response to hotspot volcanism.

Finally, Chap. 7 touches upon the historical background of the plume hypothesis, its criticisms, and alternate ideas.

This book should be useful to research students studying lithospheric uplifts surrounding a hot spot and its estimation, or to the casual reader interested in the plume hypothesis.

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