GEOPHYSICAL CONSTRAINTS ON STRUCTURE AND TECTONICS OF THE EASTERN ARABIAN SEA AND THE ADJOINING WEST COAST OF INDIA WITH SPECIAL REFERENCE TO THE KERALA BASIN

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Chapter IV - Interpretation of gravity anomalies in terms of lithospheric structure below the western continental margin of India (WCMI)

CERTIFICATE

I certify that the thesis, **"Geophysical constraints on Structure and Tectonics of the Eastern Arabian Sea and the adjoining West Coast of India with special reference to the Kerala Basin"** has been prepared by Arts K. Purushotham under my supervision and guidance in partial fulfilment of the requirements for the degree of Doctor of Philosophy and no part thereof has been submitted for any other degree.

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CHAPTER I

INTRODUCTION

1.1 GENERAL INTRODUCTION

The Indian Ocean is bounded by the Africa, India, Australia and Antarctica continents which were formed after the break-up of Gondwanaland. The evolutionary history of the Indian Ocean lithosphere that originated due to sea floor spreading can be very well understood through a reconstruction of this original Gondwanaland super continent. The most important event of this reconstruction is the rifting and northward movement of India and subsequent collision of the Indian plate with the Eurasian plate as most of the major structural and tectonic features present in the northern Indian Ocean have been formed during the northward flight of India from the Gondwanaland. Unlike the Pacific Ocean, the Indian Ocean is devoid of any major ocean trenches, which means that most of the oceanic crust created in the Indian Ocean is still preserved. However, the existence of several submarine plateaus, interpreted either as uplifted oceanic crust or as continental fragments, makes the reconstruction very difficult, though study of fracture zones and magnetic lineaments and palaeomagnetic data, have rendered it possible to trace the movements of these continents and continental fragments and thus the evolution of the Indian Ocean.

The western Indian Ocean bounded by the India, Arabia, Africa and Antarctica has a varied and complex tectonic history as can be seen from the geomorphology. The region is dominated by the presence of active mid-oceanic ridges, a large number of aseismic ridges or ocean plateaus and seamounts,

numerous islands, of which, some are considered continental fragments and others of volcanic origin (Figure 1.1). The Madagascar Island, the fourth largest island in the world, is considered to be a part of the Gondwanaland. All these topographic high features divide the region into a number of deep-sea basins. The Indus Fan which is one of the largest deep sea fans of the world is located in the northern part of the area.

The active mid-oceanic ridge system in the western Indian Ocean appears as three main branches that meet at ridge – ridge – ridge junction referred to as the Rodrigues Triple Junction. The northern branch comprises three segments, which from south to north are known as the Central Indian Ridge (CIR), the Carlsberg Ridge and the Sheba Ridge. The other two branches are known as South West Indian Ridge (SWIR) and the South East Indian Ridge (SEIR). These three branches of the mid-oceanic ridges form the boundaries between the Indian, Antarctic and African plates. The identification of linear magnetic anomalies in the western Indian Ocean on either side of these spreading ridges (Figure 1.2), has led to the understanding of sea floor spreading history of the region. The mantle plumes also played a significant role either during continental break up or during northward drift of India in the region. Apart from the active mid oceanic ridge system, the region also contains a number of prominent topographic features. A few of these topographic highs rise above sea level and emerge as islands. Most notable among these topographic features are, the Agulhas plateau, the Madagascar ridge, the Mozambique ridge, the Laxmi ridge,

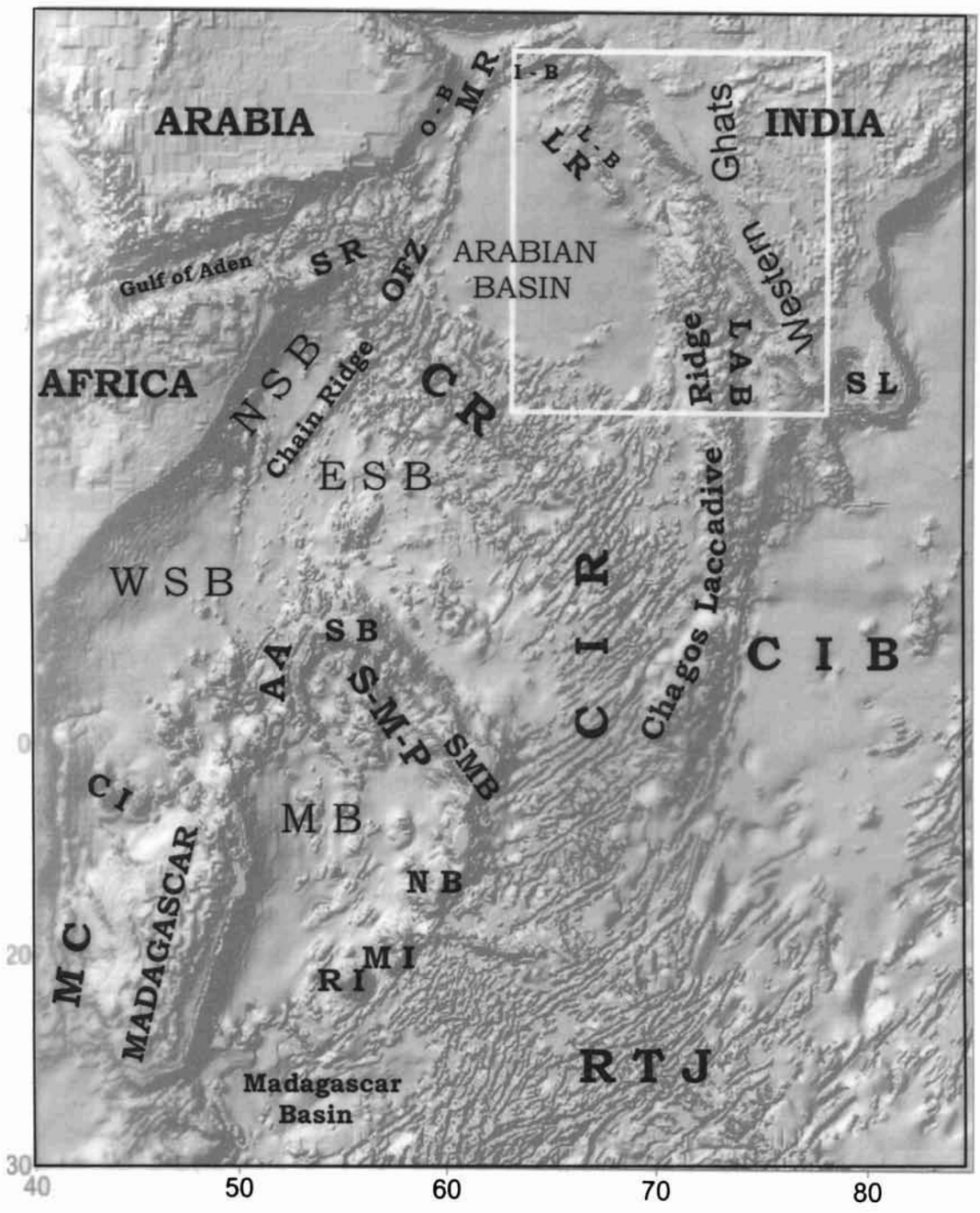

Figure 1.1 Shaded relief image of western Indian Ocean and the adjoining continents prepared based on ETOPO5 data base. Some of the prominent morphological and tectonic features are shown on the map. The area of present study is marked as rectangle (white). O-B: Owen basin, MR - Murray ridge, L-B: Laxmi basin, LR - Laxmi ridge, SR - Sheba ridge, OFZ - Owen fracture zone, NSB - Northern Somali basin, ESB - Eastern Somali basin, WSB - Western Somali basin, CR - Carlsberg ridge, CIB - Central Indian basin, AA - Amirante arc, SB - Seychelles bank, MB - Mascarene basin, S-M-P: Seychelles-Mascarene plateau complex, NB - Nazareth bank, MI - Mauritius island, RI - Reunion island, SMB - Saya de Malha bank, RTJ - Rodrigues triple junction