

Alireza Alinaghi

**RECEIVER FUNCTION ANALYSIS OF THE CRUST  
AND UPPER MANTLE FROM THE NORTH GERMAN  
BASIN TO THE ARCHEAN BALTIC SHIELD**

Dissertation  
zur Erlangung des Doktorgrades  
im Fachbereich Geowissenschaften  
der Freien Universität Berlin

vorgelegt von  
Alireza Alinaghi  
Januar 2003

Erstgutachter: Prof. Dr. Rainer Kind  
Zweitgutachter: Priv. Doz. Dr. Günter Asch

Tag der Disputation: 31. Januar 2003

**RECEIVER FUNCTION ANALYSIS OF THE CRUST  
AND UPPER MANTLE FROM THE NORTH GERMAN  
BASIN TO THE ARCHEAN BALTIC SHIELD**

by:

**Alireza Alinaghi**

Submitted to the Department of Earth Sciences  
in partial requirements for the degree of

PhD in Geophysics

at

Freie Universität Berlin

January 2003



# TABLE OF CONTENTS

|  |    |
|--|----|
| Abstract   | 7  |
| Acknowledgments  | 9  |
| <br>   |    |
| Chapter I Introduction                                     | 11 |
| Receiver function, past and present                        | 11 |
| Geologic and tectonic setting of the studied area          | 12 |
| Previous studies   | 15 |
| The approach of this work                                  | 17 |
| <br>   |    |
| Chapter II Data  | 19 |
| 2.1 Introduction   | 19 |
| 2.2 TOR  | 19 |
| 2.3 GRSN   | 23 |
| 2.4 SVEKALAPKPO  | 26 |
| 2.5 Signal quality   | 29 |
| <br>   |    |
| Chapter III Methodology                                    | 34 |
| 3.1 Introduction   | 34 |
| 3.1.1 The Moho   | 35 |
| 3.1.2 Upper mantle and the 410 and 660 discontinuities     | 35 |
| 3.1.3 Discontinuities and their fingerprints on the P coda | 36 |
| 3.2 Receiver function calculation                          | 40 |
| 3.2.1 Restitution  | 40 |
| 3.2.2 Rotation   | 42 |
| 3.2.3 Source equalization by deconvolution                 | 44 |
| 3.3 Distance equalization by move-out correction           | 46 |
| 3.4 Receiver function migration                            | 52 |

|   |           |
|---|-----------|
| 3.5 Estimating the crustal depth and Vp/Vs ratio              | 53        |
| <b>Chapter IV Results</b>                                     | <b>56</b> |
| 4.1 Introduction  | 56        |
| 4.2 Crust and the Crust–mantle boundary                       | 56        |
| 4.3 Upper mantle discontinuities                              | 72        |
| <br>  |           |
| <b>Chapter V Concluding remarks</b>                           | <b>78</b> |
| 5.1 Crust and the crust–mantle boundary along the TOR profile | 78        |
| 5.2 Crust and the crust–mantle boundary across the SVEKALAPKO | 79        |
| 5.3 The 410 and 660 discontinuities across TOR and SVEKALAPKO | 79        |
| <br>  |           |
| Zusammenfassung (German summary)                              | 81        |
| References  | 83        |
| Appendix A: Lists of Events                                   | 89        |
| Appendix B: Stations Lists & Instrumentation                  | 97        |
| Appendix C: Probing the northern Iranian crust; An overview   | 107       |
| Danksagung (Acknowledgments in German)                        | 117       |
| Lebenslauf (CV in German)                                     | 119       |