Chapter 3

Data

3.1 The passive seismic experiment BOHEMA

Between October 2001 and February 2004, the international passive seismic experiment BOHEMA (Bohemian Massif Heterogeneity and Anisotropy) was carried out, with its main period of recordings in 2002 (*Plomerová et al.*, 2003; *Babuška et al.*, 2003). It was an initiative of Czech, French and German Scientists from 10 institutions who form the BOHEMA Working Group (see Appendix A.3). The project was aimed at studying the structure and dynamics of the lithosphere and upper mantle with different seismic techniques (high resolution tomography, 3D anisotropy, receiver function analysis) as well as xenolith investigations. Altogether, 61 permanent seismic stations in the region together with 84 temporary stations deployed for time spans between 5 months up to two years could be used. Figures 3.1 and 3.2 show the station distribution of the BOHEMA experiment, Appendix A.1 gives the corresponding station parameters. The array of seismological stations forming the BOHEMA network covered a territory of approximately 270 km in N-S and 150 km in E-W direction. The aperture of the array resulted from demands of tomographic research of the crust and upper mantle down to 250 km. The network was centred on the geodynamically active part of the western part of the Bohemian Massif, around the intersection of the Eger Rift with the Mariánské Lázně Fault. The experiment was oriented with its long axis perpendicular to the strike of major tectonic units and to the Eger Rift. Three-component short-period stations represent about 1/3 of the network, while broad-band stations constitute the remaining 2/3. Average spacing of stations was about 30 km or less, especially in the central part of the array, where the station spacing was between 10 and 15 km. The stations provided continuous recordings with exception of local permanent networks (e.g. WEBNET, KRASNET) focused primarily on monitoring local seismic activity in the Vogtland/West Bohemia region. While the data quality of permanent Czech and German stations was generally high, data quality of the temporary stations varied considerably. The data amount or quality of seven temporary stations was not sufficient for further analysis. However, the BOHEMA data set as a whole provides a very large amount of good quality seismic data for investigation of the northwestern Bohemian Massif.

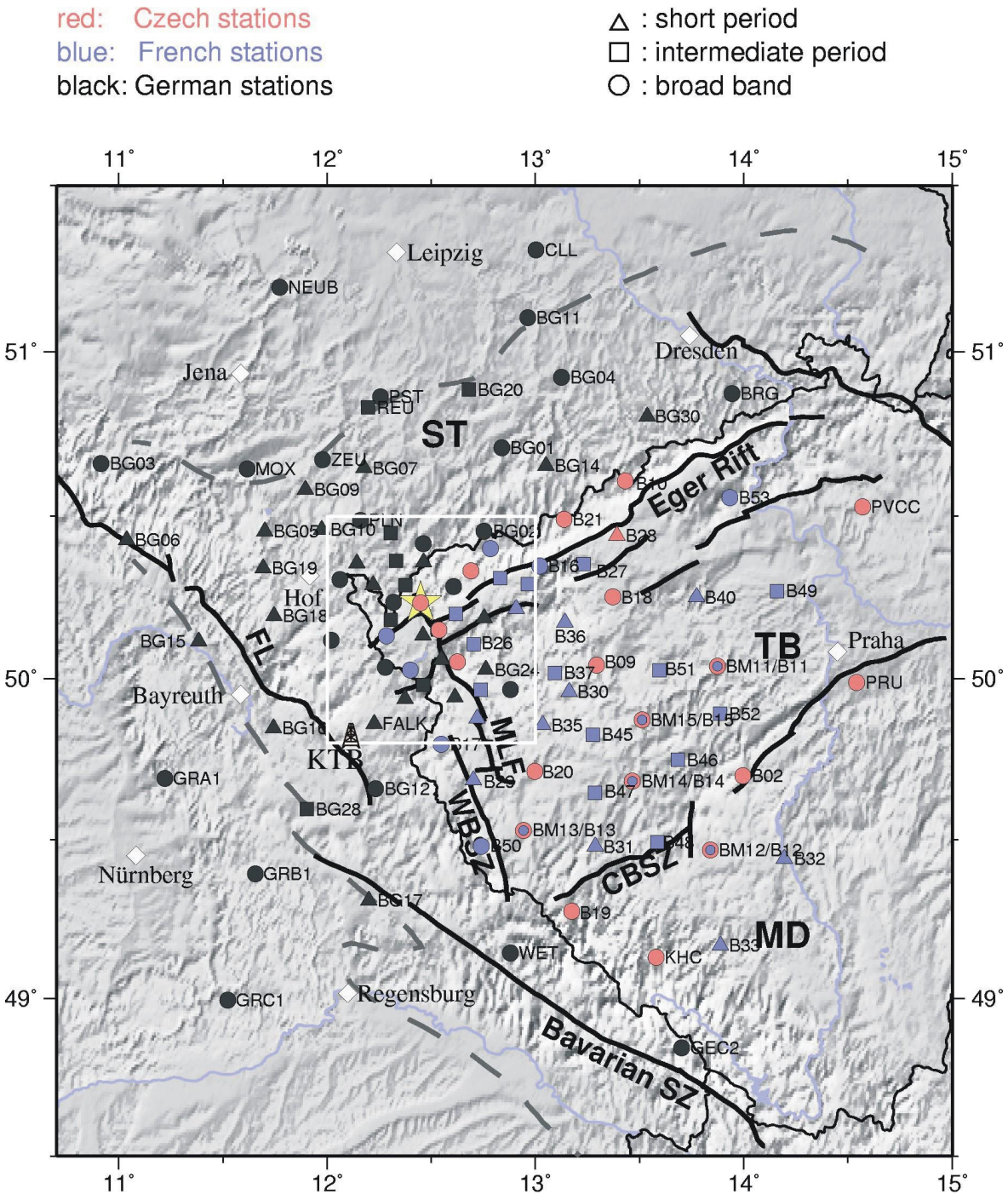

Figure 3.1: Distribution of seismic stations of the BOHEMA experiment used for receiver function analysis. The area within the white rectangle is shown again in an enlarged map in Figure 3.2. Also shown are the major tectonometamorphic units of the Bohemian Massif: Saxothuringian (ST), Moldanubian (MD) and Teplá-Barrandian (TB) block. Major faults are the Eger Rift faults, Mariánské Lázně fault (MLF), West Bohemian Shear Zone (WBSZ), Central Bohemian Shear Zone (CBSZ), Frankonian Lineament (FL) and Bavarian Shear Zone. Grey dashed line: outline of the Bohemian Massif; yellow star: main earthquake swarm area; KTB: German Continental Deep Drilling boreholes.

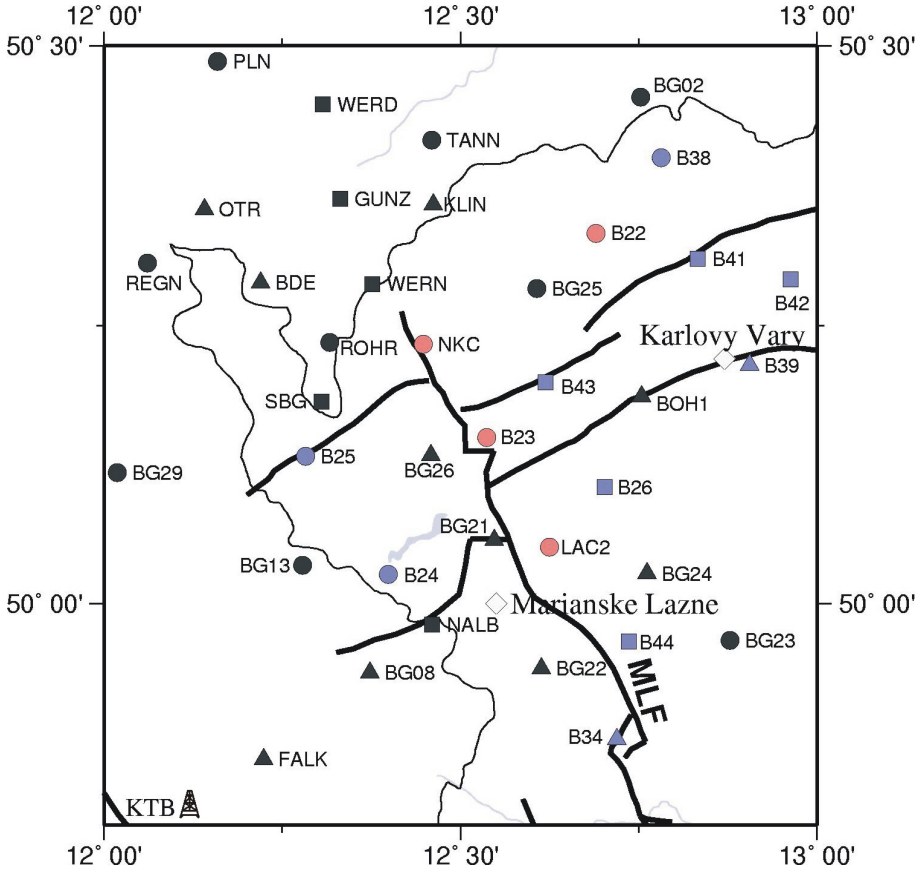

Figure 3.2: Enlarged detail of Figure 3.1 showing the BOHEMA stations used for receiver function analysis in the central part of the investigated region.

29 of the temporary stations were provided by the Geophysical Instrument Pool Potsdam (GIPP). Apart from deploying and maintaining the seismic stations, the storage discs had to be exchanged regularly, the data had to be converted into an uniform *miniseed* format and archived in the GEOFON data archive at GFZ Potsdam[1].

3.2 Data set for P receiver function analysis

For *P* receiver function analysis, the stations shown in Figures 3.1 and 3.2 were used. The selected teleseismic events have epicentral distances between 30°-95°, magnitudes larger than 5.3 for temporary stations and larger than 6.0 for permanent stations (due to the longer available recording time span) and a clear *P* onset with a high signal-to-noise ratio. The selected events are listed in Appendix B.1; their epicentre distribution is shown in Figure 3.3. A total number of 254 teleseismic earthquakes recorded by 110 broad band and short period BOHEMA stations have been used to estimate lithospheric and upper mantle structure of the western Bohemian Massif using the *P* receiver function technique, which led to more than 5000 *P* receiver function traces. Additionally, approx. 3500 receiver

[1] The GEOFON Data Center at GFZ Potsdam permits access to a large unified archive of permanent and temporary seismic network data via the internet (http://www.gfz-potsdam.de/geofon).

function traces obtained by *Geissler et al.* (2005) were used for investigation of the mantle transition zone (Chapter 7) to complement the BOHEMA data set (for station parameters and event list see Appendices A.2 and B.2, respectively).

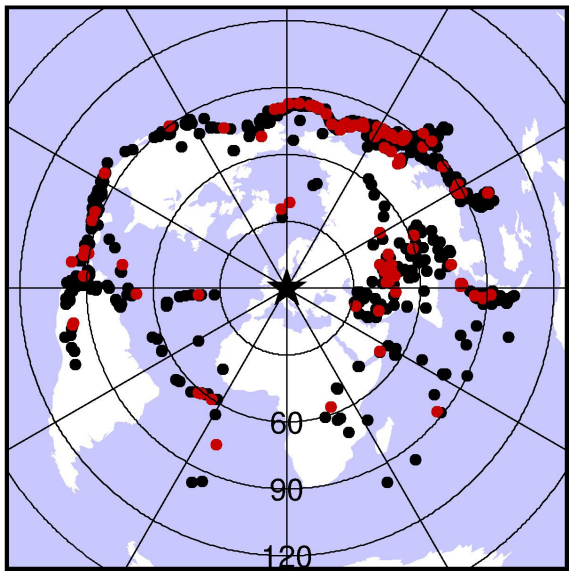

Figure 3.3: Distribution of teleseismic events used for *P* receiver function analysis in this study. Coordinates and origin times are listed in Appendices B.1 and B.2. The black star marks the location of the investigation area. Events that occurred within the recording time span of the BOHEMA experiment are shown by red dots. Events that occurred before and after that time span are coloured black and were recorded by permanent stations and/or by stations of the experiment of *Geissler et al.* (2005), whose data were used for investigation of the mantle transition zone. Due to the very long time span included by *Geissler et al.* (2005), many of the black coloured events were only recorded by few stations that operated during that time span.

3.3 Data set for S receiver function analysis

For *S* receiver function analysis, the selected events lie within an epicentral distance range of 60°-85° and have magnitudes of 5.7 and higher (Figure 3.4, Appendix B.3). A clear *S* onset with high signal-to-noise ratio was a further criterion to select events. A total number of 264 teleseismic earthquakes has been utilized to investigate the lithosphere-asthenosphere boundary (Chapter 6) in the western Bohemian Massif. Additionally, data obtained by *Geissler et al.* (2005) were used to complement the BOHEMA data set. Both data sets together result in a total number of approximately 5700 *S* receiver function traces.

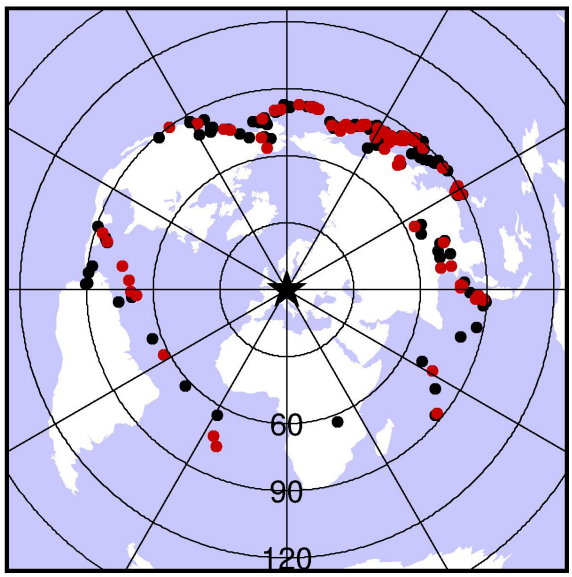

Figure 3.4: Distribution of teleseismic events used for S receiver function analysis in this study. Coordinates and origin times are listed in Appendix B.3. The black star marks the location of the investigation area. Events that occurred within the recording time span of the BOHEMA experiment are shown by red dots. Events that occurred before and after that time span are coloured black and were recorded by permanent stations and/or by stations of the experiment of *Geissler et al.* (2005).