



SEISMIC STRUCTURE AND PHYSICAL STATE OF THE EIFEL PLUME, GERMANY

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This paper is a review of the seismic work carried out in the Eifel plume project in memoriam of G. Bock, who was one of the principal investigators for this large scale international seismic project. Volcanic eruptions occurred in the Eifel mountains in the western part of Germany since Mesozoic time. Two new volcanic fields evolved in the last 600 ka and the last eruptions occurred only 11–12 ka B.P. At the same time strong uplift (up to 250 m in 600 ka) occurred in the region. To study the deep structure of the Eifel region 10 European institutions shared their facilities to operate a network with 84 permanent and 158 mobile stations including 32 broadband instruments during an 8 months field experiment. The network had a 500 km by 500 km aperture and the mobile stations were deployed between Nov-3-1997 to June-23-1998. Here we present the results of this experiment.

The P-wave model contains a column-like low-velocity anomaly (LVA, -1% to -3%) in the upper mantle underneath the Eifel volcanic fields reaching down to at least 400 km depth. The S-wave model has a prominent LVA of up to -5% in the upper 100 km of the mantle. At 200 ± 50 km depth there is no clear S-wave velocity anomaly. Below the S-wave velocity reduction is about 1%, and it extends at least to the transition zone. Teleseismic P-wave attenuation shows a strong absorption anomaly in the lithosphere and a weaker anomaly in the mantle. The lithospheric anomaly is interpreted as scattering attenuation at a magmatic intrusion zone. In the asthenosphere temperature-induced solid-state anelastic attenuation is assumed. The P- and S-velocity anomalies in the lithosphere and upper asthenosphere can be explained by an increase of temperature by about 100–150 K plus 1% melt. In the lower asthenosphere, above the transition zone, the excess temperature of the plume is at least 70 K, because the velocity anomalies are underestimated.