This report is a result of a literature study made at the RSFA. It considers the generation of seismic waves by underground explosions in rock, with special emphasis on the explosive-to-rock seismic coupling.

In the introduction, the mechanism of generation is discussed. An idealized model of the process is created. Near the explosion, strongly nonlinear effects occur in the rock because of the high pressures involved. At some distance, however, the pressures have been reduced to the elastic limit of the rock and the wave propagation is considered to be elastic. The spherical boundary surface, called the equivalent radiator, between non-linear and elastic behaviour is regarded as a radiator of elastic waves.

This idealization allows mathematical treatment of the problem. Predictions of shock wave characteristics are made from the idealized model. At some distance the radial displacement time history of the shock wave has basically the shape of a damped sine wave. The peak radial particle velocity depends on the scaled distance as (r/a)**-1, where a is the radius of the equivalent radiator.

In the following, experimental results are compared with the predictions of the idealized theory. The peak radial particle velocity from deeply buried explosions depends on the distance as C1 (r/rc)**-n, rc = radius of charge, n >= 1. C1 depends on the type of explosive and medium, while n only depends on the medium.

The period of the shock wave, T, depends on the yield W as T ü W**1/3. In a discussion it is shown that the deviation from the ideally assumed relation, 1 < n < 3 in the investigations discussed rather than n = 1, is obtained, if the ground is regarded as a low-pass filter.

For the total strain energy as a function of the scaled distance a similar relation was found

E = C2(r/rc)**-m m > 0

For ideally elastic wave propagation m = 0.

The influence of the detonation pressure of the explosive and of the ratio of characteristic impedances between explosive and rock on the peak radial strain and the total strain energy of the shock wave is discussed and experimental results are shown.

It is found that the peak radial strain is dependent on the detonation pressure and the ratio of characteristic impedances and that a closer match of the characteristic impedances means more energy transferred to the rock.

The influence of an empty or air-filled cavity around the charge on the shock wave generated in the rock is discussed. By making the cavity large enough, the wall pressure may be reduced to the elastic limit of the rock. This may reduce the strain amplitude of the shock wave by a factor of 100.