

Werk

Jahr: 1974

Kollektion: fid.geo

Signatur: 8 Z NAT 2148:40

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Werk Id: PPN1015067948_0040

PURL: http://resolver.sub.uni-goettingen.de/purl?PPN1015067948_0040

LOG Id: LOG_0042

LOG Titel: Seismic observations in Germany of a 10 t explosion off Scotland

LOG Typ: article

Übergeordnetes Werk

Werk Id: PPN1015067948

PURL: <http://resolver.sub.uni-goettingen.de/purl?PPN1015067948>

OPAC: <http://opac.sub.uni-goettingen.de/DB=1/PPN?PPN=1015067948>

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Georg-August-Universität Göttingen
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Seismic Observations in Germany of a 10 t Explosion off Scotland*

K.-P. Bonjer, W. Kaminski, and R. Kind

Geophysikalisches Institut der Universität Karlsruhe

Received December 10, 1973

Key words: Upper Mantle Structure — Seismic Long Range Profiles — Deep Seismic Sounding.

A 10 t explosion was fired at June 11th, 1972 off the west coast of Scotland (57°03.32' N latitude and 6°09.15' W longitude). Details of the explosion were reported by Jacob and Willmore (1972). The locations of the shot and the recording sites can be seen in Fig. 1. The geographic coordinates of the recording sites and the distances between the shot and the receivers are listed in Tab. 1. The mobile seismic recording stations MARS 66 (Berckhemer, 1970) were supplied and operated by the Universities of Bochum, Clausthal-Zellerfeld, Frankfurt, Hamburg, Kiel, München and Münster and by the Geologisches Landesamt of Nordrhein-Westfalen at Krefeld and the Niedersächsisches Landesamt für Bodenforschung at Hannover. The seismic stations covered the distance range between about 900 and 1700 km. Seismogram sections of the vertical components are shown in Fig. 2 and Fig. 3. Each seismogram in Fig. 2 is scaled independently to maximum amplitude. The same seismograms are plotted in Fig. 3 on a more extended time scale and on one amplitude scale for most seismograms. The amplitude scale of the seismograms at 1150 and 1173 km is unknown. The amplitudes of the seismograms at 938, 1232, 1249 and 1293 km must be divided by 0.125, 0.5, 0.5 and 0.1, respectively, in order to be on the same scale as the rest of the seismograms. The onset times of the arriving signals are not very clear due to the presence of much noise. One relatively energetic phase of first arrivals, travelling with an apparent velocity of about 8.2 km/s, can be recognized up to about 1300 km. The apparent velocity of this phase is in good agreement with a linear

* Contribution Nr. 167 within the research program "Unternehmen Erdmantel" of the Deutsche Forschungsgemeinschaft.

Contribution Nr. 102 Geophysikalisches Institut der Universität Karlsruhe.

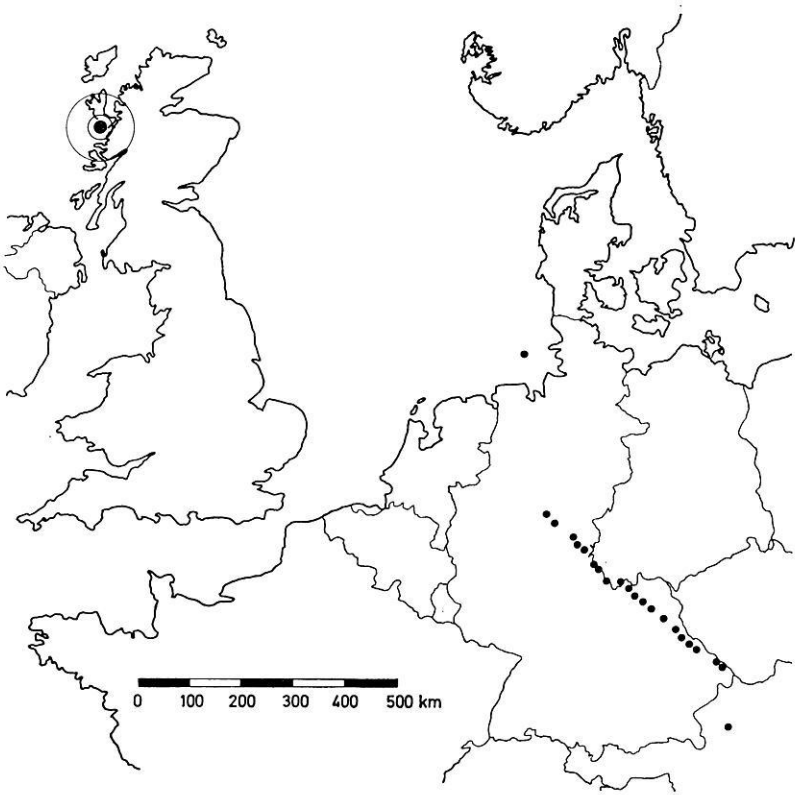


Fig. 1. Location map of shot and receivers

extrapolation towards larger distances of the first arrivals of the long range profile in France (Hirn *et al.*, 1973). Even the arrival times agree within about 0.5 s although the two shots and the receivers are located in different regions. The energy of this phase dies out rapidly beyond 1300 km distance, and the main energy is shifted towards later reduced times. There are indications for a very weak higher velocity phase around 1500 km and about 6 s reduced time.

The same explosion was also observed on a profile across France (Hirn *et al.*, 1974). The most important result of the observations in France seems to be a very energetic phase, travelling with an apparent mean velocity of first arrivals of about 8.7 km/s, between about 1000 and 1500 km. The arrival times at 1500 km, for example, are in France about 2.5 s earlier than in Germany. The difference in apparent velocity and arrival times indicates lateral variations of the upper mantle structure between France and Germany.

Table 1. Geographic coordinates of receivers and distances shot-receivers

Latitude	Longitude	Distance (km)
7° 53.03'	54° 11.08'	938.66
8° 44.38'	51° 17.09'	1150.44
8° 58.36'	51° 18.10'	1173.53
9° 27.52'	51° 04.40'	1215.93
9° 36.82'	50° 57.10'	1232.93
9° 48.37'	50° 51.75'	1249.68
10° 03.57'	50° 38.52'	1279.14
10° 11.18'	50° 32.23'	1293.53
10° 28.08'	50° 20.62'	1322.74
10° 48.43'	50° 20.63'	1341.07
11° 02.98'	50° 12.83'	1363.61
11° 12.52'	50° 04.47'	1382.33
11° 27.27'	49° 59.37'	1408.84
11° 42.82'	49° 51.97'	1424.89
12° 01.48'	49° 42.20'	1453.68
12° 21.48'	49° 30.60'	1485.98
12° 32.08'	49° 24.23'	1503.39
12° 43.75'	49° 16.72'	1523.21
12° 54.98'	49° 11.10'	1540.32
13° 22.38'	48° 57.88'	1581.51
13° 35.97'	48° 51.15'	1602.19
13° 47.88'	47° 51.18'	1689.28

A comparison of our data with the upper mantle model of Mayer-Rosa and Müller (1973) shows that the observed phase of 8.2 km/s is in good agreement with this model. However, very energetic higher velocity phases of later arrivals, which are also predicted by this model in the same distance range, are not detectable in our data.

A comparison of our data with the results from the Early Rise explosion shows, that on the Canadian Shield and in the northeastern part of the United States much higher velocities, around 8.5 and 8.6 km/s, are observed in the same distance range (Massé, 1973). Even in the western part of the United States, where the possible low velocity zone is much more pronounced than in the East, a strong phase of about 8.6 km/s starts at about 1000 km distance (Massé, 1973). This is similar to the observations in France (Hirn *et al.*, 1974) but it does not agree with our data. Wiggins and Helmberger (1973) have observed in the western United States an apparent velocity of about 8.4 km/s up to about 1000 km distance, which is only a little higher than the velocity reported in the present paper. However, they also observed a clear phase of second arrivals with a much higher velocity, starting at about 1000 km distance. In our data the first weak indication for a velocity

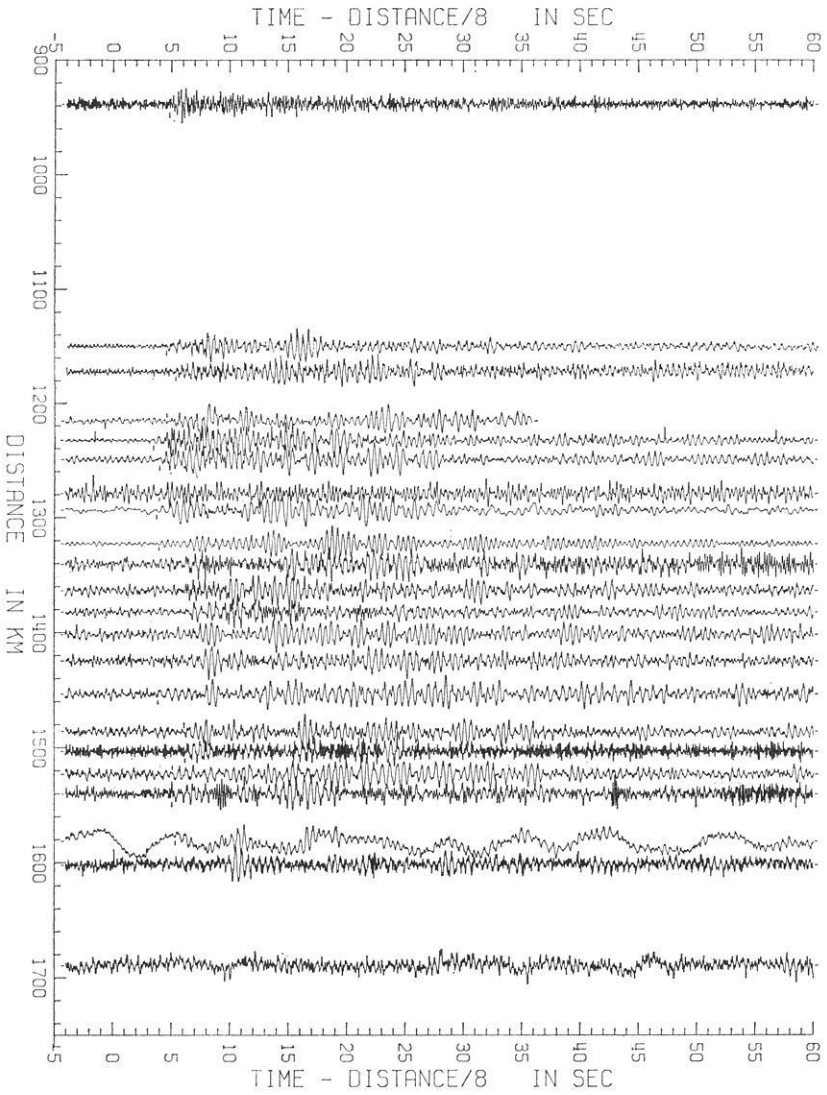


Fig. 2. Seismogram section of the vertical component of the observed seismograms

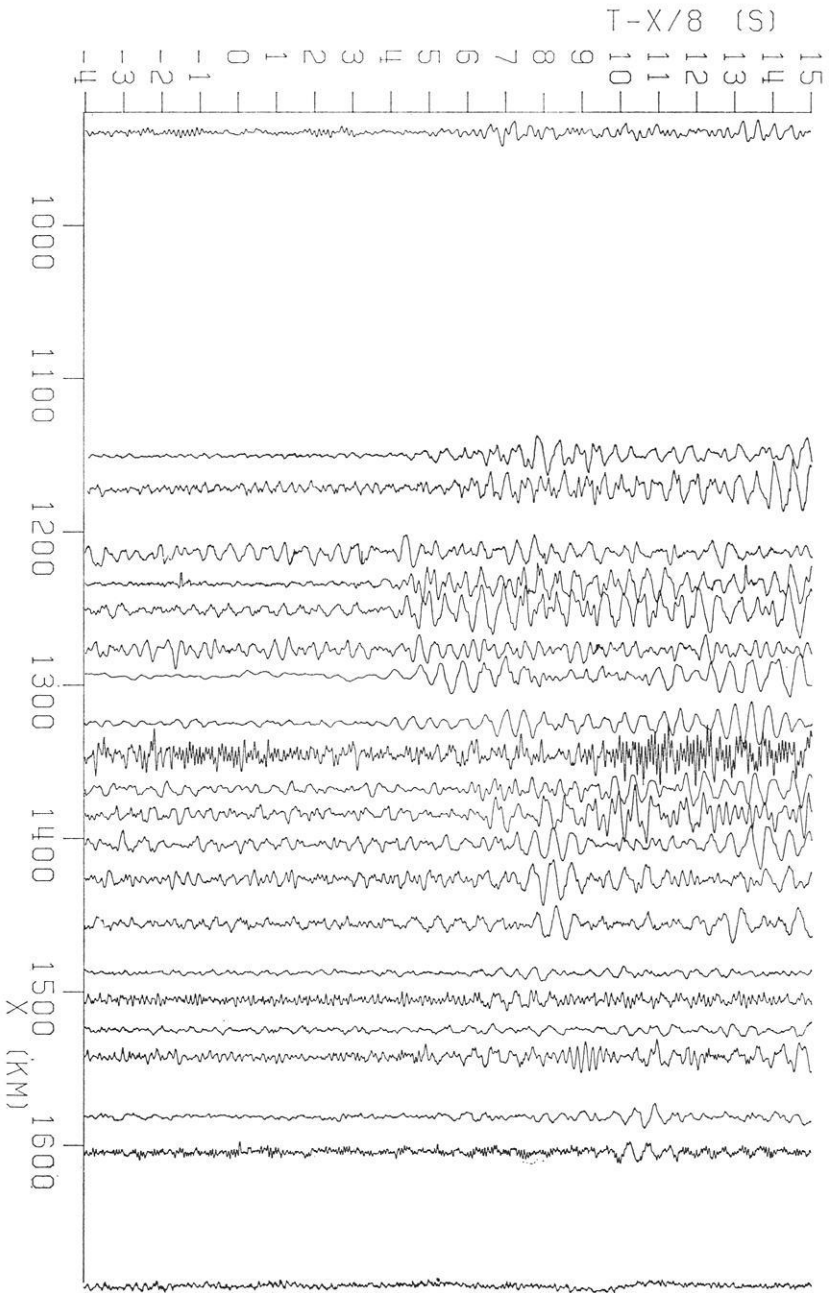


Fig. 3. Same seismograms as in Fig. 2 on a more extended time scale and filtered between 0.5 and 15 Hz. See text for amplitude scale

higher than about 8.2 km/s is at about 1500 km. This indicates that the apparent upper mantle velocity between Scotland and the south-east of Germany is clearly lower than most velocities observed elsewhere.

No attempt has been made to deduce a velocity depth model from the presently available data since observations in shorter ranges are lacking.

The observations of the Scottish explosion in Germany were suggested by Prof. Dr. Karl Fuchs. We wish to thank all the participants in this experiment. This work was sponsored by the Deutsche Forschungsgemeinschaft.

References

- Berckhemer, H.: MARS 66 — a magnetic tape recording equipment for deep seismic sounding. *Z. Geophys.* 36, 501–518, 1970
- Hirn, A., Steinmetz, L., Kind, R., Fuchs, K.: Long range profiles in western Europe: II. Fine structure of the lower lithosphere in France (southern Bretagne). *Z. Geophys.* 39, 363–384, 1973
- Hirn, A., Perrier, G., Steinmetz, L.: 10 t explosion off Scotland 1972 observed in the distance range 900 to 1500 km in France. *Compt. Rend. Acad. Science*, in press, 1974
- Jacob, A. W. B., Willmore, P. L.: 10 t explosion fired in 1971 and 1972. Proc. 13th General Assembly of the European Seismological Commission, Brasov, in press, 1972
- Massé, R. P.: Compressional velocity distribution beneath central and eastern North America. *Bull. Seism. Soc. Am.* 63, 911–935, 1973
- Mayer-Rosa, D., Müller, St.: The gross velocity depth distribution of P- and S-waves in the upper mantle of Europe from earthquake observations. *Z. Geophys.* 39, 395–410, 1973
- Wiggins, R. A., Helmberger, D. V.: Upper mantle structure of the western United States. *Z. Geophys. Res.* 78, 1870–1880, 1973

Klaus-Peter Bonjer
Werner Kaminski
Rainer Kind
Geophysikalisches Institut
D-7500 Karlsruhe 21
Hertzstraße 16
Federal Republic of Germany