

Seismotectonics and seismic hazard in the Roer Valley Graben; with emphasis on the Roermond earthquake of April 13, 1992

Workshop recommendations

H.W. Haak

Section of Seismology, Royal Netherlands Meteorological Institute, P.O. Box 201, 3730 AE De Bilt, the Netherlands

For many decades the active movements on the faults of the Rhine Graben system and associated tectonic structures have been considered to be the cause of the earthquake activity in this region. The Roer Valley Graben boundary faults, namely the Peel Boundary and Feldbiss faults, are connected to the Rhine Graben structure south of the region shaken on April 13, 1992, by the Roermond earthquake. This region has experienced several strongly-felt shocks in the past few hundred years, the larger ones being 1756, 1878 and 1951. The maximum (credible) earthquake for the region, which is an extremely rare event, has long been held to be not much greater than the 1992 Roermond event. This magnitude was for the last time exceeded in 1756.

Although rare and unpredictable in terms of time of occurrence and location, such events could produce disastrous levels of damage in the region. Contemporary scenarios for great cities are emphasising the need for earthquake-impact studies in areas hitherto not considered to be vulnerable, such as the Roer-Rhine region. This collection of papers provides a state-of-the-art overview by consolidating existing knowledge, highlighting areas of current research, and presenting a multifaceted set of conclusions and recommendations. Knowledge of the impact of the Roermond earthquake of 1992 has raised the issue of vulnerability of such densely populated and highly developed areas at a time when global seismic hazard initiatives are creating similar awareness in less-developed regions of the world. In this sense, these papers complement and support the International Decade of Natural Disaster Reduction (IDNDR).

The workshop of January 20–22, 1993 at Veldhoven, the Netherlands, provided the opportunity for a large number of earthquake scientists and engineers

from six countries to discuss the significance of earlier research into the Roermond earthquake and its effects. Damage was particularly widespread in the Netherlands and Germany, the areas of greater ground response being in the southernmost areas of the Netherlands. The recommendations compiled at the workshop by the organising committee have been incorporated into the following recommendation statements:

Recognising:

- The lack of a coordinated geo-information bank for the Lower Rhine Embayment;
- The importance of international and interdisciplinary data exchange within earthquake hazard and risk analysis;
- The importance of high-quality digital waveform data for earthquakes in Europe for scientific research and seismic hazard and risk assessment;
- The lack of knowledge of the deep crustal structure of the Roer Valley Graben and its surroundings;
- The significance of recording aftershocks for accurate site response, and structural studies of the epicentral area;
- The importance of accurate historical catalogues in seismic hazard assessment;
- The lack of a systematic approach to the description of the geotechnical effects of earthquakes in northwest Europe;
- The importance of paleoseismic studies to the earthquake record;

We note the importance of:

- EMSC (European and Mediterranean Seismological Center) and ORFEUS (Observatories and Research Facilities for European Seismology) as data management centers in Europe;

- (existing) cooperation for quick data exchange within Europe (for example the Transfrontier Group);
- A single arrival time data file for the mainshock and the aftershocks;
- A single database of all available data for the mainshock and the larger aftershocks;
- Joint evaluation of macroseismic data for large northwest European earthquakes in a coordinated international effort;
- The development of Geographic Information Systems (GISs) and databases as a tool for the assembly of an earthquake and geotechnical database;
- Preparedness and cooperation in quick deployment of aftershock instrumentation;

We recommend:

- To install high dynamic range (mobile) accelerographs in the region;
- To implement 'open' seismograph stations;
- To upgrade data loggers to modern 20–24 bit resolution and short-period sensors to broad-band seismometers;
- To maintain an inventory of digital seismological stations that are willing to contribute their data to a common, easily accessible database;
- To consider the Standard for the Exchange of Earthquake Data (SEED) as the standard format for archiving of seismological waveform data;
- To form one geo-data bank for the Roer Valley Graben and its immediate surroundings;
- To initiate and stimulate studies of the deep structure for the Roer Valley Graben and its surroundings;
- To classify geological and geophysical data for the research on the Rhine Graben system neotectonics;
- To subject historical earthquake catalogues to rules of historical criticism (information should be based only on contemporary sources);
- To develop a European palaeoseismicity research program;
- To construct a database and a map showing the location of geotechnical and structural damage phenomena as a consequence of the Roermond earthquake;
- To develop a uniform international terminology and symbology for the recording and displaying of earthquake geotechnical phenomena and structural consequences;
- To form an international pool of mobile seismographs for aftershock monitoring.

July 1994