SEISMIC ACTIVITY IN THE GERMAN DEMOCRATIC REPUBLIC

W. Sponheuer[I], G. Grünthal[II], A. Kunze[I], P. Bormann[II]

SUMARY

The seismicity of the GDR, the seismic regionalization of its territory as well as first results concerning the correlation between recent horizontal deformations of the earth crust and seismity are presented.

REVISED MAPS OF EPICENTRES AND MAXIMUM OBSERVED INTENSITIES

A comprehensive knowledge of basic seismological data for the region under investigation is a prerequisite to any proper assessment of earthquake risk. As compared with the main seismic regions of the world the seismicity of the GDR is rather small but not negligible. During the last 1000 years, which have been completely catalogued, medium earthquakes with magnitudes up to about 5 have occured repeatedly. Starting from about 1500 A.D. the available macroseismic data on events seem to be rather complete and accurate. Therefore epicentre maps could be drawn beginning with that year (Fig. 1 and 2). The macroseismic data were converted into magnitudes.

For the Vogtland swarm earthquake region, one of the two main centres of seismic activity in the southern part of the GDR, the data allow a quantitative interpretation back to about 1850. The other major area of seismic activity is situated north of the Vogtland swarm earthquake region near to the district capital Gera. In large areas of the western part of the GDR no earthquakes were observed prior to 1900. With the beginning of our century intensive salt mining started in that region entailing induced seismicity along preexisting and prestressed tectonic fracture zones. The strongest seismic events in the mining area reached magnitudes up to M = 5.

All available intensity data I = 4 ^{o} since 1500 were collected and isoseismal maps from the main shocks of the area were constructed. The isoseismal map of maximum observed intensities (Fig. 3) directly derives from these data. The map of J_{max} is dominated by the isoseismals of the earthquake of March 6, 1872, with its epicentre east of Gera. This was the strongest quake ever observed within the territory of the GDR (M = 5.2). The above mentioned events in mining areas with foci very close to the surface cause high local intensities decreasing rapidly with distance.

REGIONALIZATION OF THE TERRITORY

The regionalization of the area under investigation, i.e. the delimination of seismic source zones constitutes an important step in

[I] Prof. Dr. Wilhelm Sponheuer and Ing. Alfred Kunze, Academy of Sciences of the GDR, Central Earth Physics Institute, Jena Branch, DDR - 6900 Jena, Burgweg 11

[II] Dr. Gottfried Grünthal and Dr. Peter Bormann, Academy of Sciences of the GDR, Central Earth Physics Institute, DDR - 1500 Potsdam, Telegrafenberg

processing seismicity data. Fig. 4 shows the seismic regions of the territory as derived from regional characteristics of seismic activity and of geotectonics. The log N-M curves were derived for each region (Fig. 5).

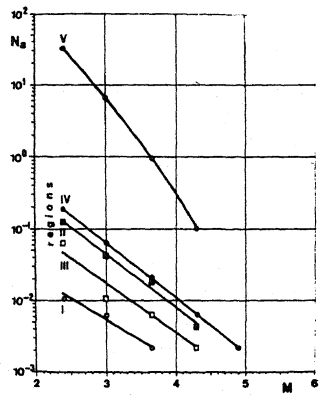

Fig. 5. Annual frequency of magnitudes in the seismic regions of the GDR

The regions IV and V are distinct narrow seismic source zones. The region V corresponds to the Vogtland swarm earthquake area. More than 5000 felt shocks registered in the last one hundred years were concentrated in single swarms each lasting for a few days, weeks ore month with magnitudes up to 4.7 of their largest shocks. The log-N-M distribution of region V shows a clear dropping of the frequencies for higher M-values. The b-value of the corresponding straight line fit is abnormally high (b = 1.35). From the data we can conclude, that significantly stronger events than the ones observed so far are not likely to occur in view of the specific seismotectonic situation of that area. Therefore this very active area has a relatively low seismic risk depite of being the area of maximum seismic energy flux within the territory of the GDR. The log-N-M curves of the other regions have b-values between 0.6 and 0.8 indicating seismic characteristics differing significantly from those of region V.

HORIZONTAL CRUSTAL MOVEMENTS AND SEISMICITY DISTRIBUTION

Active fracture zones must be considered in seismic zoning. In the case of the GDR it was found that the correlation between zones of major seismic activity and zones of maximum horizontal crustal deformations as computed from geodetic precision measurements carried out in 1890 and 1960, respectively, is definitely negative (Thurm et al., 1977). From this it was concluded that the areas of main shear deformations occur mainly in areas with large extensions. As a rule the shear strain is negligible in the zones exhibiting significant compression. Exceptional areas with a coincidence of EW shear strain and NW-SE compression are the Vogtland region and the source zone of the strong shock in 1872 east of Gera.

REFERENCES

Thurm, H., Bankwitz, P., Bankwitz, E., Harnisch, G. (1977), Rezente horizontale Deformationen der Erdkruste im Südteil der Deutschen Demokratischen Republik, Petermanns Geogr. Mitt. 4. 281 - 304

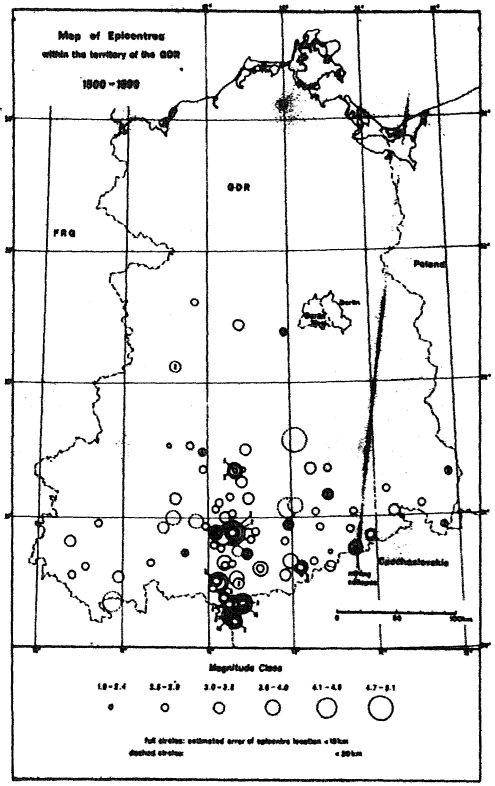

Fig. 1 Map of epicentres within the territory of the GDR between 1500 and 1899

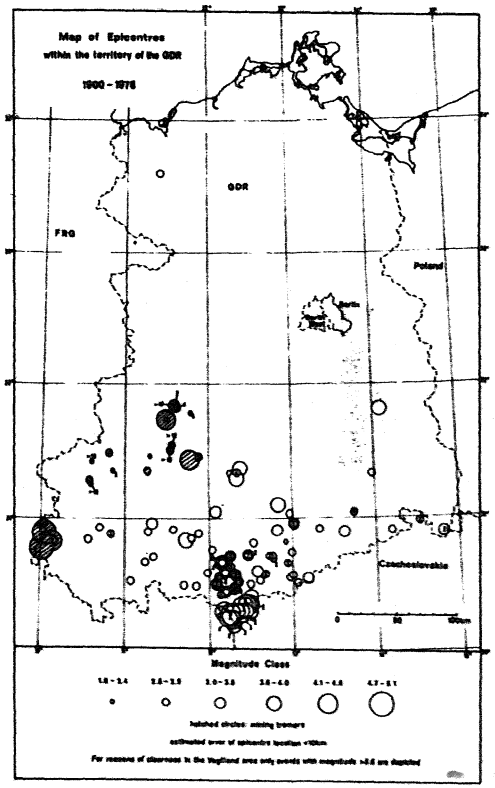

Fig. 2 Map of epicentres within the territory of the GDR between 1900 and 1978

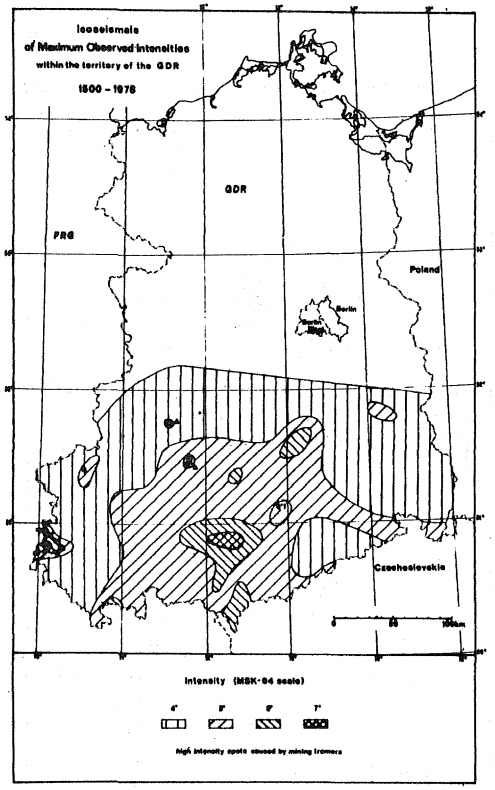

Fig. 3 Isoseismals of maximum observed intensities within the territory of the GDR between 1500 and 1978

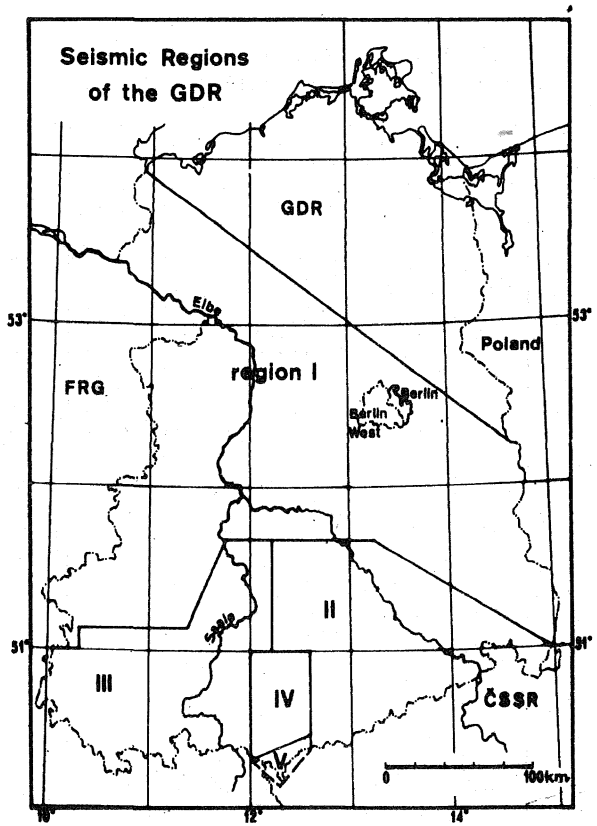

Fig. 4 The seismic regions of the GDR