O8-14 THE BELT SEISMICITY - A GEODYNAMIC EXPRESSION IN KRESNA-KROUPNIK SEISMOGENIC ZONE

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Introduction

The new idea for the belt seismicity as a common, general expression of the recent geodynamic appeared several years ago. [1]

The main characteristics of this process can be summarised as follows:

- It appears on/as elongated zones, but relatively narrow in the dimensions (lengths and depths).
- It appears in the active geodynamic areas of intensive compressional or extensional regime. In the large scale these are zones of subduction, rifts, transverse faults). In smaller scale, these are different geomorphologycal structures - grabens, horsts, flexures, other smaller tectonic blocks.

Almost always the belt seismicity demonstrates the following peculiarities:

- Continuous fulfilments of seismic gaps in time and space.
- Large brittle fault ruptures (expressed by frequent low energy seismic emission) or/and large destruction of the medium during large earthquakes and/ or relatively big creep movements.
- High emanations of deep origin earth gases (Rn, Xe, He,…) in the extensional zones
- Block structure and differential block movements up, down or transversal in the regions where it is expressed.

Kresna-Kroupnik seismogenic zone - an example of the belt seismicity

Looking for such characteristics we were able to find a relatively clear example in so called Kresna-Kroupnik seismogenic zone (SW Bulgaria). The zone is characterized as a hard rock belt All other secondary coseismic events after the big events at 1904 have been wide spread on the territory of about more then 200 sq.km. After the field expedition in 1998 about 200 local active landslides have been recognised in the different parts of the Simitly graben, which has relatively small dimensions (30x20km) [4]. The biggest part of them has been located on/or in the very near vicinity of the active faults [5] in the region. Some of them tend to express an antitethyc direction to the central part of the graben and it is visible even on the some fault's surfaces on the outcrops.

- The seismicity in this zone appears in the narrow elongated zones. It has the highest-level earthquake activity in Bulgaria. (Fig.1) [2]. The observed earthquakes - for example during the time period 1992-1994 show clear E-W elongation in the epicentres in two parallel belts. They outline well the source dimensions of the both strong shocks in 1904, and the flanks of Simitli graben.
- After the strong crustal earthquakes in 1904 (M7.2 and M7.8 in 20 minutes time domain), vertical displacements up to several meters have been observed [3].
- The seismicity appears in a typical graben structure (Simitly graben), which expressed very large recent subsidence of the central part and big uplifting of the peripheral blocks to south and north.
- The active extensional regime have been observed by measurements in situ by several extensometers deployed in the sensitive points.[5]. The extensional regime of the zone have been proved as well by many investigators on the seismic regime, the focal mechanisms and the fault plain solutions of about 70 local earthquakes [6]. It is important to mention that the zone have a lot of local faults many of them active in seismic or creep regime. Several GPS measurements show the same regime by geodetic research applied there. Following the general idea of the suspected "belt seismicity" effects we tried to find some more improvements about the extension regime of the zone.
- Extremely high emissions of Rn (about 50 000 Bq/m3) have been observed by the measurements in the seismic station located over the fault. (fig.2)

Following the general idea for the extensional regime of the zones, a radon monitoring program was established in the Krupnik seismic station, which is located just over the surface ruptures of the big 1904 events by Centre Universitaire of Luxembourg (CUNLUX).

The executed measurements by the ALPHAGUARD device covered a time period of about 4 months with hourly samplings of radon concentration, room temperature air pressure and humidity.

Due to the very bad thermal isolation of the measuring location installed in the basement of the

station, the influence of external condition above all external temperature, on the Rn concentrations was very high. As shown on fig. 2 radon concentrations can reach very high levels of about 50 kBq/cub.m.

During periods of highest seismic activity 14 events up to 3.5 magnitude in the month of April, radon concentrations reached the highest levels and had the highest fluctuations. But a direct link of radon to this increased activity looks hazardous. Due to the changing circulation of outside temperature gradients very high fluctuations are observed. The radon levels show that the subsoil has a high potential of underground radon, which can be due to an extended fracture regime, bellow the measuring location.

- The geodetic measurements show differential vertical (maximum about 3-5 mm/y, in average 2-3 mm/y) and horizontal movements of the different blocks located in and surround the Simitly graben.[5]

A lot of recently active landslides (more than 220 on an area of about 30 x 20 km) in different structures have been observed in the region as an improvement of the big geodynamic activity of this area [4].

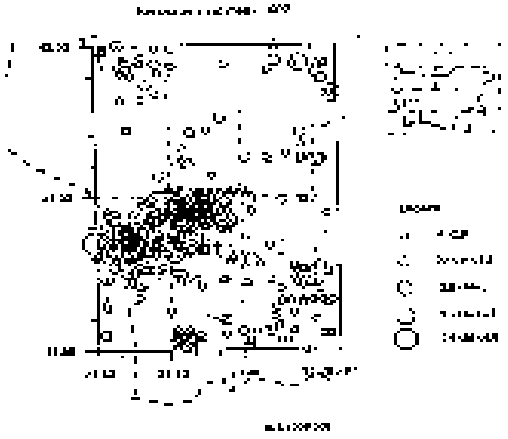

Fig.1. Local seismic events in the Kresna-Krupnik zone

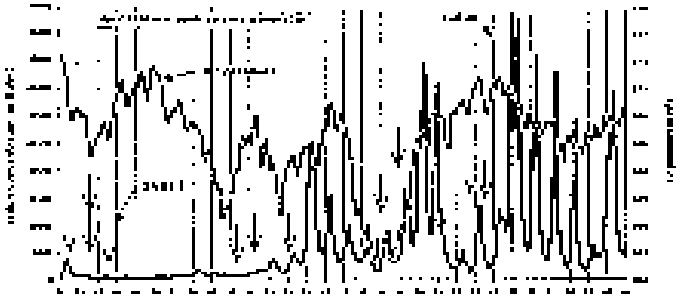

Fig.2. Rn concentrations, air pressure and seismic events near the Kresna seismic station (Apr.'98)

Conclusions

A lot of data and facts support the large geodynamic activity and the extensional regime in the Kresna-Krupnik seismic zone. For the first time so called “belt seismicity” has been recognized and used for the explanation of the geodynamic regime in the Kresna-Krupnik seismic zone. An investigation based on radon measurements can help in the recognition and improvement of the geodynamic regime of this very active zone.

References

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Acknowledgments

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