P12-1	TECTONIC MOVEMENTS ALONG KROUPNIK FAULT (SW BULGARIA), ESTABLISHED BY IN-SITU EXTENSOMETRIC MONITORING, AND THEIR RECENT DEVELOPMENT

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The region of SW Bulgaria is one of the most seismoactive in the territory of Republic of Bulgaria. The Kroupnik fault is located there. Recent seismic and tectonic activity in this region was all the time connected with the dynamics of this fault as well as with one of the strongest European earthquakes in the last two centuries (April 4, 1904, M=7.8). An attempt was made to study our days tectonic movements in this region using in-situ monitoring. After a special field investigation along the trace of the Kroupnik fault, a suitable point was found in 1982. Spatial extensometer TM-71, Czech product, was installed there in an agreement program between Bulgarian and Czech Academies of Sciences. The monitoring point is known as Brezhani-6 (B6) and it has coordinates 41.86N/23.17E.

The extensometer TM-71 enables 3-D in-situ detection of deformations with a long-term accuracy of 0.01 mm. The measurements have been taken once monthly as well as after local seismic events felt in the studied area. Results of the long-term monitoring are presented in Fig. 1 in three Cartesian coordinates (+X - fault zone extension; +Y - sinistral shear along the fault trace (20°); +Z - normal faulting, -Z - thrusting). The diagrams provide displacements, where tectonic movements and local effects (rock temperature fluctuations of a sinusoidal character), together with seismic events (recorded as skips mostly) are superposed. A routine instrumental temperature compensation is made.

It is only along the X-axis movements, where a prominent sinusoidal character due to temperature fluctuations in the rock massif can be well seen. Amplitudes vary from 4 to 6 mm. However, present dynamics of the fault prevails in the records. Eight periods can be recognized. These are displayed in Table 1. Details recognized in the earlier periods were discussed elsewhere.

Recently, an interesting phenomenon was detected, as seen in this table. Rates of movements along axes Y and Z were generally decreasing from January 1988 till October 1998. In the period August-September 1998, a characteristic sign change in the rate appeared, which is notably well seen in the Y-coordinate. Then, on October 26, 1998 a local earthquake with magnitude about 3.5 occurred. Registered co-seismic deformations in absolute numbers were: ΔX=4.4 mm, ΔY=1.8 mm, ΔZ=2.7 mm. After this earthquake, the movement rates along the fault at this point increase in axes Y and Z, again.

Generally, the measurements, which are presented in the diagram, show that Y and Z are the main directions of the most consistent tectonic movements of a non-seasonal character. The total length of the sinistral displacement vector of shear till January 25, 1999 is $|u_{yz}|$ = 52.84 mm. It means an indication of a significant and systematic tectonic movement along the fault, with a reverse-sinistral oblique-slip reading 3.21 mm/a. Vector length of the total 3-D displacement as recorded for the whole period is $|u_{xyz}|$ = 55.44 mm, which corresponds to 3.37 mm/a.

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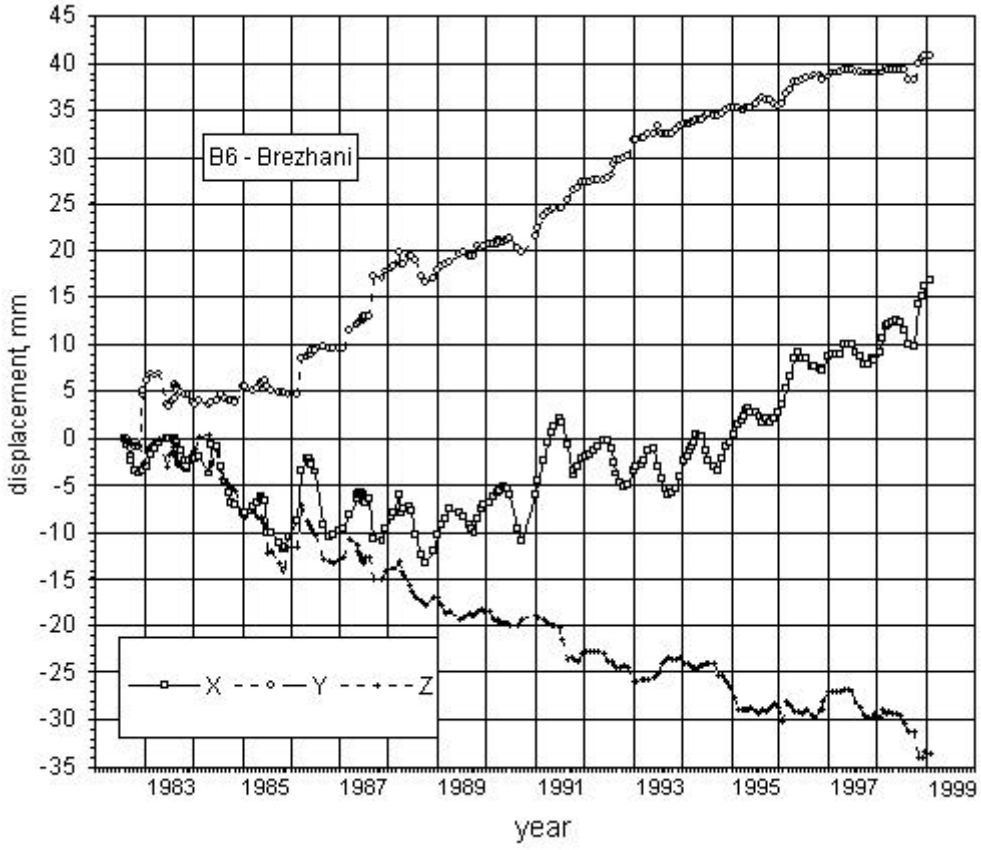

Fig. 1. Displacements found at point B6 within the period August 12, 1982 - January 25, 1999

Table 1. General trends found at point B6

Period	Component		
	X	Y	Z
Aug. 1982 – Dec.1983	About +0.9 mm/a extension of the fault zone	about +3.5 mm/a sinistral movement	about –1.5 mm/a thrusting (uplifting Neogene basin)
Jan. 1984 – Oct. 1985	–4.39 mm/a fault zone compression	+1.16 mm/a sinistral movement	–9.28 mm/a thrusting
Nov. 1985 – Dec. 1987	+1,07 mm/a fault zone extension	+4.63 mm/a sinistral movement	–0.98 mm/a thrusting
Jan. 1988 – Dec. 1992	+1.89 mm/a fault zone extension	+2.60 mm/a sinistral movement	–1.92 mm/a thrusting
Jan. 1993 – Apr. 1996	+2.93 mm/a fault zone extension	+1.51 mm/a sinistral movement	–1.89 mm/a thrusting
May 1996 – Jul. 1998	+1.44 mm/a Fault zone extension	+0.54 mm/a sinistral movement	–0.34 mm/a thrusting
Aug. – Sep. 1998		–0.15 mm/a dextral movement	+0.25 mm/a normal fault movement
Oct. 1998 – Jan. 1999	Fault zone extension	about +3.7 mm/a sinistral movement	normal fault movement ?