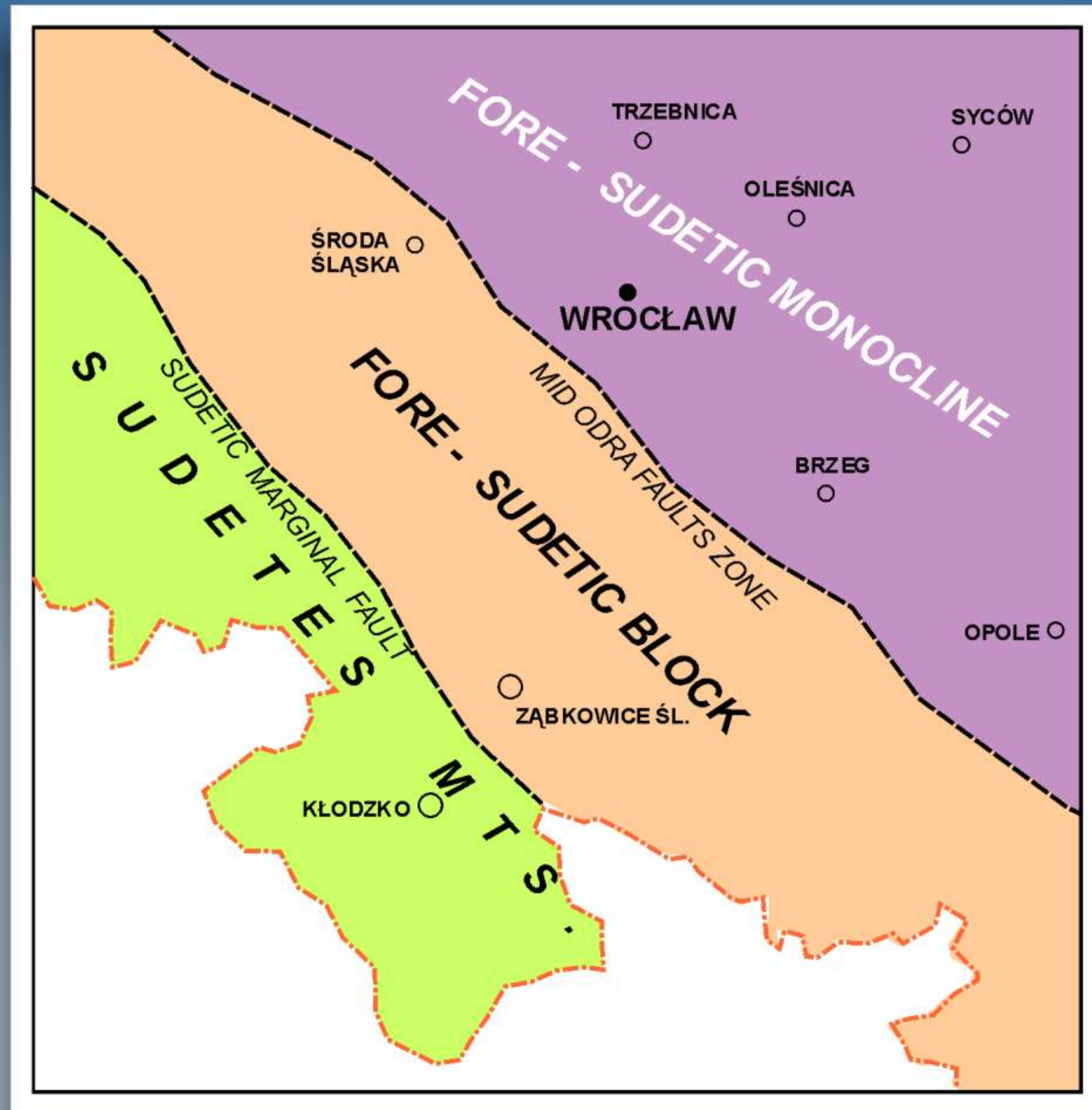


DISPLACEMENTS OF BENCHMARKS VS. GEOLOGICAL CONDITIONS IN LOWER SILESIA



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The aim of the research is to determine the correlation between geological conditions of the ground surface and vertical benchmarks displacements. The area of interest covers selected zones of Lower Silesia and focuses on the Middle Odra Faults Zone and Sudetic Marginal Fault Zone. The authors want to verify the thesis that Cainozoic deposits thickness have influence on vertical displacements of benchmarks in 1957 – 2002 period.

Area of investigations covers the three tectonic units of Lower Silesia (SW Poland): Fore Sudetic Monocline, Fore Sudetic Block and Sudetes Mts. (fig. 1) divided by the fault zones. In that area the thicknesses of deposits reach their values from 0 (Sudetes Mts.) to the 650 meters (the Paczków Graben) below the ground surface. Because of that geologic diversity the area is adequate to testing the thesis.

Authors have interpolated the thickness of the Cainozoic deposits (additionally the thickness of the Quaternary and Tertiary ones were interpolated) in the benchmarks sites with the use of two [1],[2] maps of Cainozoic strata. The displacements were analysed on the eleven national levelling lines of the first order (fig. 2) consists totally of 331 benchmarks. Benchmarks relative displacements were calculated with the condition of the one fixed benchmark on each levelling line. The correlation coefficients were calculated between the relative displacements and the thicknesses of Quaternary sediments and Tertiary strata (tab. 1).

Fig. 1. Main tectonic units of Lower Silesia

Tab. 1. Correlation coefficients of the benchmarks displacements and Cainozoic deposits

No.	Levelling line	Number of benchmarks	Correlation coefficients		
			Quaternary	Tertiary	Multiple
1	Jawor – Jelenia Góra	15	0,564	0,600	0,608
2	Jawor – Lubawka	46	0,469	0,518	0,558
3	Ząbkowice – Rogoźnica	36	-0,120	-0,204	0,221
4	Wrocław - Kawice	53	-0,065	0,059	0,070
5	Wrocław - Krotoszyn	28	-0,361	0,446	0,613
6	Wrocław – Syców	25	0,268	0,196	0,317
7	Wrocław - Opole	24	-0,672	-0,747	0,795
8	Wrocław - Ząbkowice	46	-0,657	-0,693	0,799
9	Ząbkowice - Paczków	24	-0,499	-0,449	0,537
10	Paczków - Kłodzko	31	0,191	0,464	0,470
11	Rogoźnica - Jawor	36	0,728	0,687	0,739

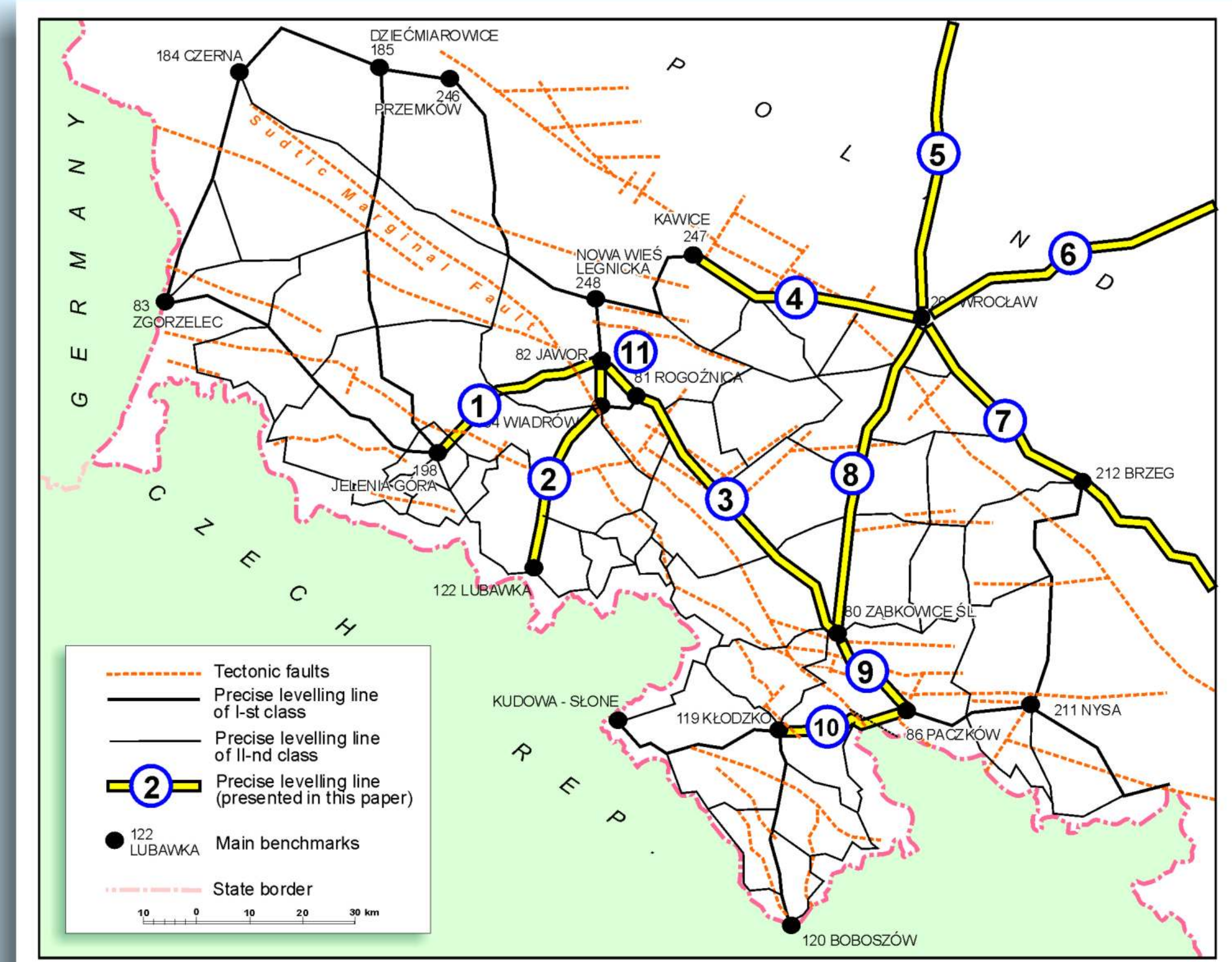


Fig. 2. Location of the analysed levelling lines

By the use of the multiple robust regression (Huber weight function), the trend line for the total population was found (fig. 3a, 3b, 3c). On the figure 4 the example geologic cross-section (Ząbkowice - Wrocław - Syców) is shown. It is visible that the searched correlation exists which is confirmed by the regression plots for that line (fig 5a, 5b). From the eleven levelling lines, the three lines (marked in the table 1) have significant correlation.

Fig. 3. Linear robust regression for total benchmarks content (331 sites)

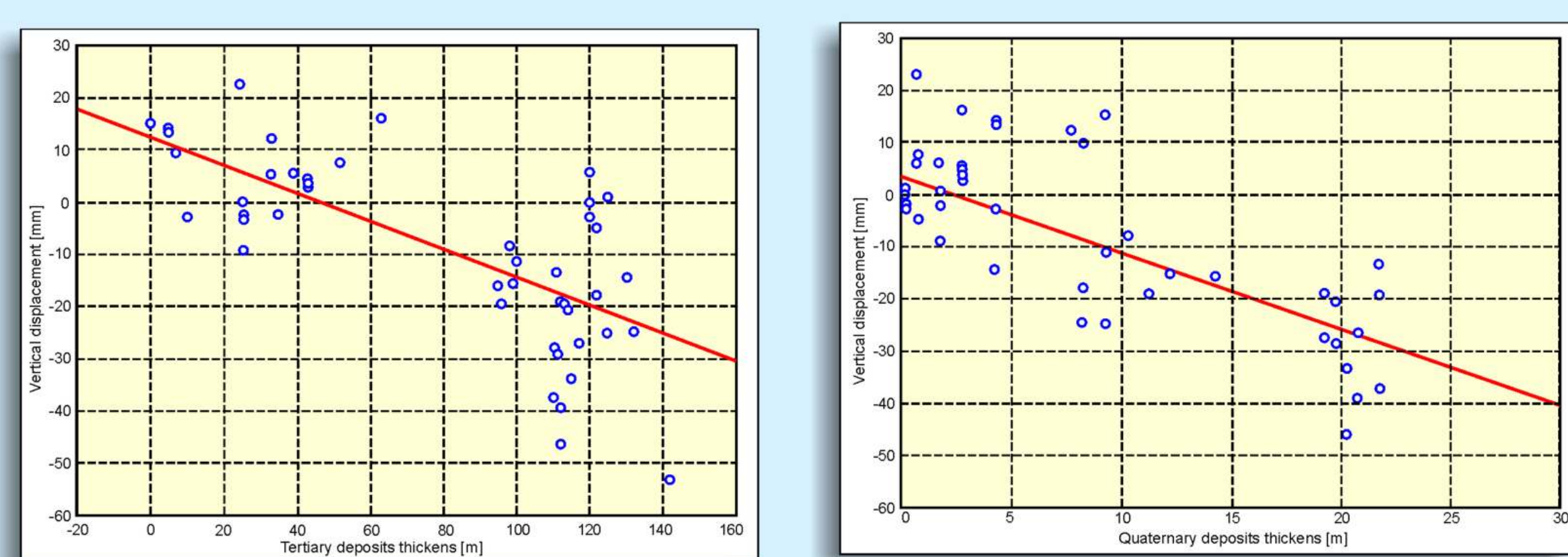
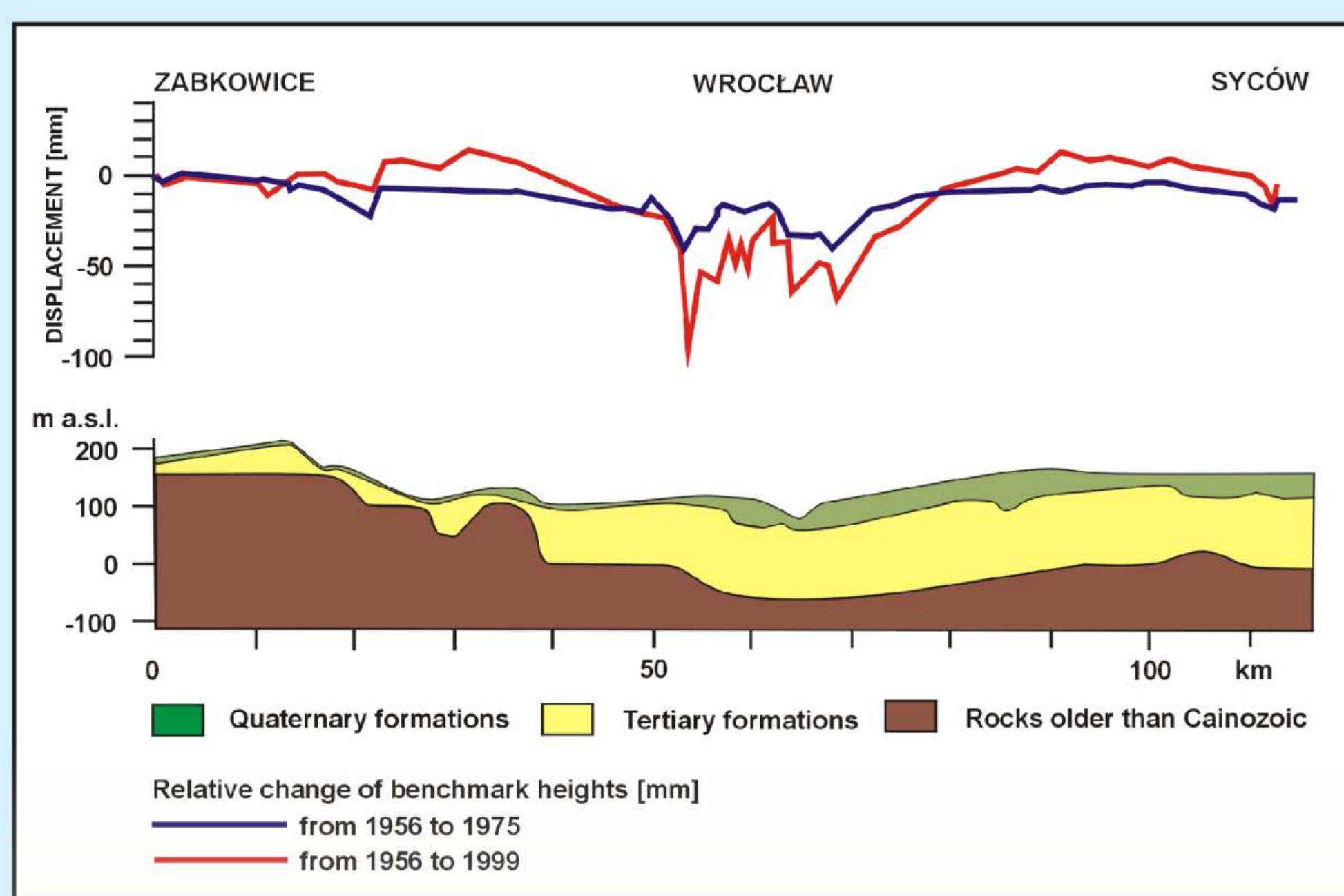
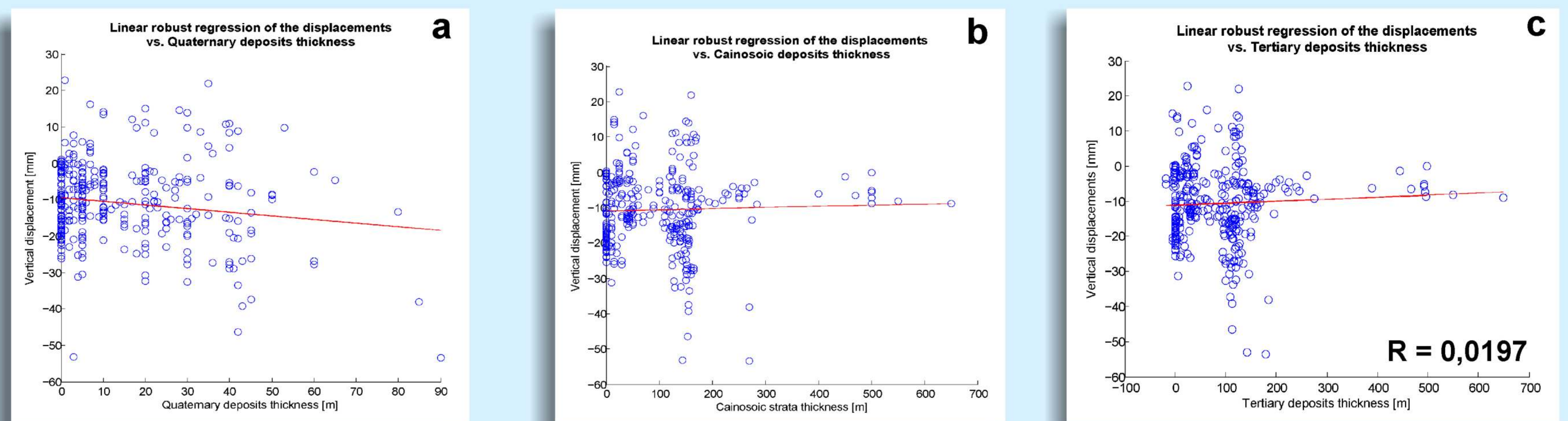


Fig. 4. Cross-section of the Cainozoic deposits and trend lines of displacements (levelling lines number 8 and 6)

Conclusions

Analyses did not show correlation between the Cainozoic deposits thickness and vertical benchmarks displacements. The multiple correlation coefficient for total population is not significant $R = 0,0197$ (fig. 3c). The exceptions are three levelling lines: Wrocław - Ząbkowice, Wrocław - Opole and Rogoźnica - Jawor. These lines do not cross the main tectonic faults zones of Lower Silesia. The lack of correlation might be caused by the tectonic movements and local stabilization conditions.

References

- [1] J. Badura et al. (2004). Map of Thickness of Cainozoic Strata in SW Poland, Cainozoic evolution of Lower Silesia, SW Poland: A New interpretation in the Light of Sub - Cainozoic and Sub - Quaternary Topography. Acta Geodynamica et Geomaterialia, Vol 1, No.3 (135), p.21.
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