Quaternary tectonic activity along foreland preexisting dislocation – some evidence from the Kleszczów Graben (south–central Poland)

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The late Alpine Kleszczów Graben is locted in the southern part of Łódź Upland and constitutes the easternmost structure of the tectonic depressions system which extends on the epi-Variscan platform, north of the West Carpathian Front. It may be assumed that Cenozoic development of Kleszczów Graben was strongly influenced by reactivation along pre-existing NE–SW, NW–SE and WNW–ESE dislocations in the Permo–Mesozoic subsurface. The exact timing, kinematics and origin of the Tertiary–Quaternary movements in this area are still being discussed.

Presented field studies in the "Bełchatów" open cast mine involved the analysis of large number of clastic dikes and related structures, which are located just above unexposed, NW–SE trending, preexisting faults in Mesozoic bedrocks. The clastic dikes were observed within vertical open fractures and normal faults in gently folded clayey-sandy sediments (the Upper Miocene–Pliocene?) and strike parallel to their host faults. The largest were traced at a distance of over 1 km. The vertical extent can be estimated at 70–80 m and majority of the structures show a tendency to die out in the uppermost part of the underlaying coaly sediments of the Middle Miocene. In general, clastic dikes were divided into four main genetic groups: infilling by collapse, slow gravitational transport, intrusion of liquified sands, squeezing-in of ductile material. The type of infilling within individual fissures can change along the strike, and more commonly, with depth. Particularly significant is the occurence of composite dikes consisting of lateral sequence of different infillings originated as a result of multistage opening and infilling of fractures. Thus, opening of fissures, particularly the more advanced ones, seems to have been a relatively, long-lasting process with distinct succesive stages. In the case of uconsolidated deposits both processes took place: opening of fissures and their filling must have developed contemporaneously. Analysis of dike sediments indicates that they formed in the Quaternary. Restriction of the analysed structures to the wide zone of anticlinal crest, parallel to the fold axis, indicates that they could have formed as a result of tensile stress related to the folding. The commonly observed termination of fissures downwards at the Upper Miocene–Middle Miocene contact, can be explained by tensile stress drop towards the neutral surface in folds. The fold deformations which developed simultaneously with opening of the fractures was generated by movements along NW–SW striking pre-existing dislocations.

Quantifying finite deformation in mountain belts – the Andes and the Jura mountains

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With better coverage of fold and thrust belts with high quality, "balanced" cross sections, we begin to have dense, and seemingly reliable data on the displacement of the crust over long time intervals – normally as long as the process of orogenesis itself. More thought than ever is being put into drawing cross sections based on simple enough principles. Fewer people so far have made the move into combining cross-section data and restoring things in "map" view. The principles of how to do this are, however, well-established and date from the same time as the development of balanced section techniques.

Any map view restoration will give finite displacements for a region of the earth's crust. These displacements have a meaning. We can use them in calculating finite strains predicted as a consequence of any structural model.

The regional strain pattern can then be used in a number of ways. For instance: