

Origin of curved traces of the regional thrusts and fault-related folds in the Polish Outer Carpathians in the light of analogue modelling

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Upper Jurassic to Lower Miocene rocks of the Polish Outer Carpathians (POC) were deformed into the pile of nappes, which are named, from S to N, the Magura, the Fore-Magura–Dukla Group, the Silesian, the Subsilesian and the Skole pile of nappes (Książkiewicz, 1977). In traditionally opinion, the POC belt was formed from hinterland to foreland during Oligocene and Miocene. In the thrust belts the most folds are generated by the thrust fault movement at depth (e.g. Groshong, 2007). The typical thrusts has the ramp-flat geometry (e.g. McClay, 1992; Groshong, 2007). There are three types of ramps according to their orientation with respect to the transport direction as follows: frontal ramps which are approximately perpendicular to the transport direction; lateral ramps approximately parallel and oblique ramps at an intermediate angle. The ramp-flat geometry is also characteristic for the thrust in the POC. Curvature of the contractional structures in map-view is one of the main features of the typical mountain belts. In the Western Outer Carpathians the major thrusts are also generally not linear. The traces of single, small thrusts are mostly convexly curved. The traces of large, south-dipping thrusts or regional fold axes have curvilinear or wavy outline. For example, the trace of the Brzanka-Liwocz-Podzamcze anticline axis in the Silesian nappe, in the eastern part of the POC shows the step-like outline.

In our experiments, we investigated the role of fault linkage in the process of thrust fault growth. All experiments were performed at the Laboratory of Analogue Modelling,

in the Institute of Geological Sciences, Polish Academy of Sciences. During experiments the isolated single thrusts linked along-strike into a large, segmented thrust with a single, continuous fault trace. When these segments, small thrusts were aligned along more or less longitudinal line or slightly convex arc, the trace of such larger segmented thrust was mostly slightly convex towards the direction of tectonic transport. When the location of such segments was more chaotic, then the trace of the final thrust had the curvilinear or wavy outline. The shape of this outline depended on the kind of transfer faults (being lateral or oblique thrust) which connected the small thrust faults.

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