free passage for compensating asthenospheric flow below or on sides of the subducting slab. In the case of the Carpathian arc confining continental lithosphere represents an obstacle for the asthenospheric "sideflow", which is more efficient than the "bottom" flow. However, evolution of the arc type andesite volcanism testifies about division of the subducting slab into three major segments, corresponding roughly to the West Carpathians, northern part of the East Carpathians and southern part of the East Carpathians, allowing the asthenospheric "sideflow" to take place via "windows" between the segments.

Subduction affected first during the Late Oligocene to Early Miocene time internally situated Penninic/Magura and Transcarpathia /Szolnok flysch zones, later during the Early Miocene to Pliocene time externally situated Silesian/ Krosno/Moldavian flysch zone. Subduction in the external zone is considered as a new subduction zone formed following accretion of the Silesian Cordillera to the upper plate. It started at the West during Early Miocene (20 Ma) and sinking slab has reached the magma generation depth of 120–150 km during the Early Sarmatian (12.5 Ma), while at the East it started during Badenian (16–15 Ma) and sinking slab has reached the magma generation depth during the Late Pannonian to Pleistocene (9–1 Ma). Such the timing sets the average subduction rate at 1.5–2 cm a year. With the exception of NE Carpathians the subducting slab has reached the "magma generation" depth during the last stage of convergence in the almost vertical position. The short-term volcanic activity implies a limited width of the subducted crust (less than 150 km) or a progressive detachment of the sinking slab from the platform margin. The final detachment of the sinking slab is confirmed by results of seismic tomography, while it is still in progress at the Vrancea seismic zone.

Migration of subduction processes eastward was reflected in corresponding migration and reorientation of back arc extension zones. The arc type andesite volcanism associated in individual segments with the subsidence of extension basins, which are situated at the back of the accretion prism, parallel to the arc, as an immediate product of the subduction pull. The areal type silicic and andesitic volcanism associated with the evolution of the pull-apart and basin & range (horst/graben) type structures further in the hinterland of the arc. Areas of thinned Crust and Lithosphere corresponding to Tertiary extension basins localize places of the diapiric upraise of asthenospheric mantle, which was coupled intimately with subduction processes in the outer flysch zone of the Carpathian arc. Late stage alkali basalt volcanics testify, that during the final stage in evolution of the arc the compensating asthenospheric flow has reached the zone of back arc extension and diapiric upraise of asthenosphere incorporated unmetasomatized mantle material.

Migration of subduction processes eastward caused also a reorientation of the upper plate movement and of the lateral escape of lithosphere from the Alpine collision. While it was northerly during the Early Miocene (combined with anticlockwise rotation due to oblique collision with the continental margin), it was northeasterly during the Middle Miocene and easterly during the Late Miocene time.

Lateral variations along the Apennine and Dinaride foreland basins

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The elongated mountain belts of the Apennines and the Dinarides and the basins at their flanks, associated with opposite directed subduction of the Adriatic plate, are an excellent location to study lateral variations in basin shape and internal organization. A wealth of new, high quality seismic data enables us to systematically analyze such variations. The basins developed during the Neogene and Quarternary. The present-day foreland basin of the Apennines is continuous along the entire belt and is characterized by its highly variable shape along strike. At present a foreland basin is lacking along most of the Dinarides, except in the South Adriatic Sea, where an uncharacteristically deep basin has developed. Despite large differences in basin infill and organisation, they are everywhere covered by a relatively large package of Quarternary sediments, often forming distinct progradational fans.

Six sections covering the entire belt of the Apennines and extending far into the foreland towards the Dinarides and the Alps are modeled using an elastic flexural model. The lateral variations in basin shape can be mostly explained in terms of changes in load distribution, but pre-existing differences in initial bathymetry are quite important. The lithospheric strength on the other hand is small and does not vary a lot.

Modes of Polish Trough inversion and its relationship to Alpine collision - from the Baltic Sea to the Carpathians

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Orogenic processes are often responsible for variations in evolution of sedimentary basins located in the far-field of the evolving orogenic belt. Also, development of various foreland inversion structures within the brittle upper crust is often connected to evolution of orogenic belts. These structures can often be investigated using seismic reflection profiles that show both inverted and rotated basement blocks as well as folded and faulted rocks of sedimentary infill. Polish Trough (PT) has evolved in Permian to Cretaceous times along broadly defined Trans-European Suture Zone. It has already been postulated for a long time that its Late Cretaceous inversion could be correlated with Alpine collision and transmission of compressional stresses into the foreland plate – i.e. European Plate. However, only very limited number of publications has been published so far with seismic examples of inversion-related structures. This was mainly due to fact that bottom part of the basin infill contains thick series of Zechstein evaporites that strongly attenuate seismic energy. Therefore straightforward interpretation of inversion structures was either difficult or impossible.

Completed interpretation of offshore and onshore seismic data from various parts of the PT revealed numerous examples of inversion-related structures. Their identification allowed for spatial and temporal interpretation of various aspects of the PT inversion and its relationship to Alpine collision. A model for development of various upper crustal brittle inversion structures was constructed, taking into account relative role of Zechstein salt deposits for formation of these structures, as well as relationship between inversion processes and salt tectonics.

First group of inversion-related structures related to Late Cretaceous inversion of the PT consists of uplifted basement blocks and large reverse faults that cut both Palaeozoic basement and Mesozoic basin infill. They are generally oriented NW–SE and could be regarded as extensional faults that controlled development of the PT and become inverted in Late Cretaceous. They were identified in the N part of the PT (Baltic and Pomeranian segments), in NW surroundings of the Holy Cross Mts, and in Lublin Trough. Syn-inversion sedimentary features like thickness reductions above fault-related folds hinge, or sediment progradation away from uplifted blocks, accompany some of these faults. In all these areas Zechstein evaporites are either absent or of small thickness. In the central part of the PT, where evaporites are of considerable thickness, presumed inversion of older extensional faults was restricted to pre-Zechstein section. It has resulted in basement block rotation, development of inverted faults and basement highs, and formation of various related salt structures. Such relationship between inversion and thickness of salt deposits suggest that, most probably, PT inversion was to at least some degree controlled by thickness of ductile Zechstein evaporitic deposits. They may have acted as detachment level between brittle Palaeozoic basement and Triassic to Cretaceous sedimentary infill and prevented formation of fully developed Mesozoic inversion structures in areas of thick salt.

Along the NE edge of the PT, in places characterised relatively thin Zechstein cover, series of transpressional (flower) structures and related inverted faults formed in Late Cretaceous that cut high into the Cretaceous section. These structures were described along so-called Koszalin–Chojnice anticline and attributed to PT inversion. Numerous seismic unconformities observed above this anticline combined with well information allowed for precise dating of inversion tectonic activity. Steep reverse faults and flower structures related to strike-slip movements, accompanied by prominent syn-inversion sediment progradation, were also identified in the wide tectonic fault zone between Bornholm island and the Polish coast.

Alpine collision to the south has led to tectonic movements also along faults perpendicular to the