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Deep seismic reflection profiles in SE Poland reveal a Variscan thin-skinned fold-and-thrust belt encroaching the East European Craton

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Recent years have brought a significant progress in understanding of the external Variscides in Poland. Combined POLCRUST-01 and PolandSPAN deep seismic surveys imaged for the first time a Variscan thin-skinned fold-and-thrust belt that encroaches onto a little deformed basement slope of the East European Craton (EEC) much farther eastward than the previously postulated position of the Variscan deformation front. This deformed belt consists of several tectonic units, to a various degree overprinted by Variscan shortening and inversion. These are the Małopolska Block, Łysogóry Block, Radom-Kraśnik Block (RKB) and the Lublin Basin (LB) from the hinterland to the foreland (SW-NE), respectively. While the two latter represent a Variscan thin-skinned fold-and-thrust belt, the Małopolska Block can be considered a backstop of this thin-skinned deformation belt.
The seismic data show a continuous top-EEC basement that descends SW-ward from ∼2 to ∼20 km under a Variscan fold-and-thrust belt. The RKB and LB represent a NE-vergent thin-skinned system overthrust toward the EEC. The former unit is a thrust stack that imbricates a 10-12 km thick pile of Neoproterozoic to Devonian sediments. Its leading edge is a triangle zone related to the jump of the basal detachment from a basement-cover interface to Silurian shales. The passive roof of this triangle zone involves Carboniferous strata. The minimum thin-skinned shortening in the RKB and the LB is ∼15-20 km. This has been transferred from the SW which testifies for the Variscan emplacement of the Małopolska Block onto the margin of the EEC and a continuity of the basal detachment.
These recent advances stimulate questions how was the shortening transferred from internal zones of the Variscan orogen and how was it partitioned above the southwestern margin of the EEC. Although the emplacement of the Małopolska Block over the subsided EEC margin is clearly a driving force of Variscan folding and thrusting in the adjacent thin-skinned belt a source of this shortening remains problematic. This is because the correlation between regional tectonics and Variscan kinematics of the newly discovered fold-and-thrust belt is not obvious. Kinematic analysis of the Kraków-Lubliniec Fault, a long-lived and polydeformed contact zone between the Małopolska Block and the Brunovistulian Terrane adjacent from the south, indicates intervening phases of dextral and sinistral displacements in the late Carboniferous. This suggests an interplay of two sources of tectonic compression: one in the WSW and the other one in the SSE. While the former may be correlated with the northern branch of the Variscan orogen, the latter points at the present Carpathian area. Indeed, a southern source of Late Carboniferous shortening is not visible in the Moravo-Silesian fold-and-thrust belt that records a late Carboniferous dextral transpression and eastward emplacement of thin-skinned thrust sheets onto the Brunovistulian foreland. Therefore, we tentatively propose that the late Carboniferous dynamics of the newly discovered thrust-and-fold belt was controlled by the SE branch of the Variscan orogen that was originally separated from the NW by the Brunovistulian intramontane massif, and later fragmented by a Mesozoic rifting and reworked during the Alpine orogeny.