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The Trans-European Suture Zone (TESZ) is a broad and complex zone of terrane accretion separating ancient lithosphere of the Baltic Shield and East European Craton (EEC) from the younger lithosphere of western and southern Europe. There is debate about the number of terranes involved, and their origins. The most significant terrane boundaries, originally oceanic sutures, are poorly exposed, and are defined using faunal provinciality. Prominent geophysical lineaments may represent sub-terrane boundaries within composite terranes. The Avalonia Composite Terrane was amalgamated to Baltica in latest Variscan time. The provenance of the Malopolska and Moravo–Silesian terranes, whose Neoproterozoic basement is suspect with respect to Baltica, but with which they nonetheless share faunal affinities, is still debated. The extent of the Variscide Rhenohercynian Zone defines the southern limit of the early Palaeozoic-accreted terranes. Terranes within the Bohemian Massif exhibit HP metamorphism recording subduction-driven collision prior to incorporation in the TESZ collage, itself associated with a HP event. In Romania, the Saxothuringian Zone (and Rhenic Suture) are directly juxtaposed with the EEC, and the crustal structure of the TESZ has been much modified by post-Palaeozoic tectonism. Deep seismic reflection data, where available, show that the oceanic sutures are frequently associated with inclined reflectivity zones (IRZ) in the lithospheric mantle, here inferred to mark relict subduction zones. Interpreting the age of subduction is complicated by offset of originally coplanar mantle and crustal segments of the IRZ, resulting from early orogenic lithospheric delamination at the Moho interface and/or post-orogenic ‘reordering’ processes. The mantle IRZ appear to indicate a N-directed polarity for early Palaeozoic subduction, apparently incompatible with the geological evidence, which indicates subduction of the Tornquist Sea beneath Avalonia, and a large amount of underthrusting of Avalonia by Baltica. Possible explanations for these apparently incompatible observations are evaluated.