

Variscidy



Symetrické uspořádání

Severní křídlo

Dorzální pásmo

Jižní křídlo

Subvariská zóna

Renohercynsko-jihoportugalská zóna

**Sasko-durynská zóna
Moldanubická zóna**

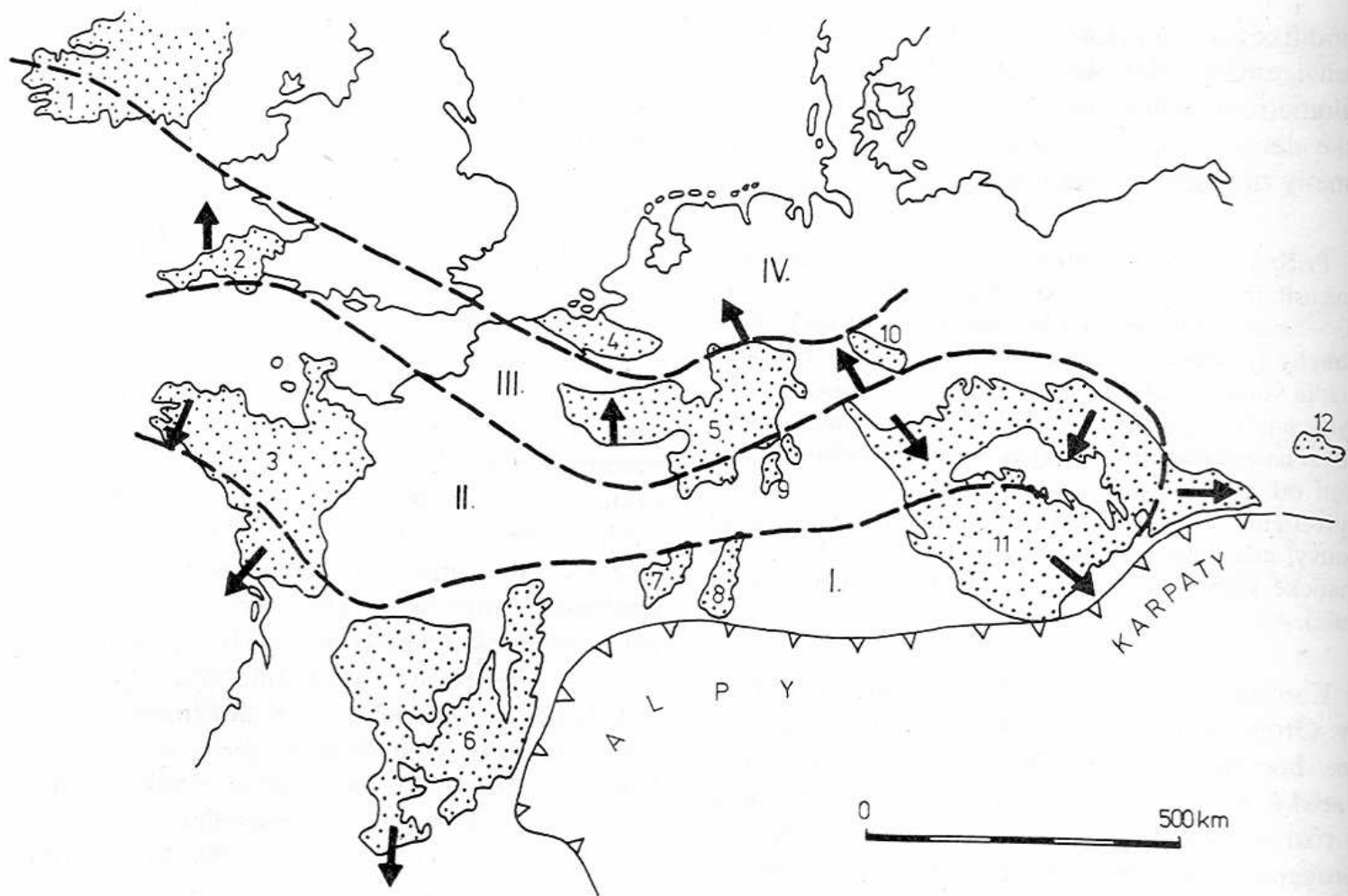
Vendésko-limousinská zóna

Cevenská zóna (Iberia)

Avalonie

Armorické společenstvo teránů

Iberie



Obr. 278. Zjednodušená schéma variscíd strednej a západnej Európy (upravené podľa F. PATOČKU, 1980, s použitím dát M. G. RUTTENA, 1969, C. F. BURRETTA a J. GRIFFITHSA, 1977 a W. KREBSA, 1975).

I moldanubická zóna a jej ekvivalenty, II sasko-durýnska zóna a jej ekvivalenty, III rhenohercýnska zóna a jej ekvivalenty, IV subvariská zóna a predpolie variského orogénu. Na povrch vystupujúce časti variscíd (vybodkované): 1 južné Írsko, 2 Cornwall, 3 armorický masív, 4 brabantský masív, 5 Ardeny a Porýnska bridličnatá vrchovina, 6 Massif Central, 7 Vogézy, 8 Schwarzwald, 9 Odenwald a Spessart, 10 Harz, 11 český masív, 12 Svätokrížske hory. Šípky znázorňujú prevládajúcu vergenciu vrás

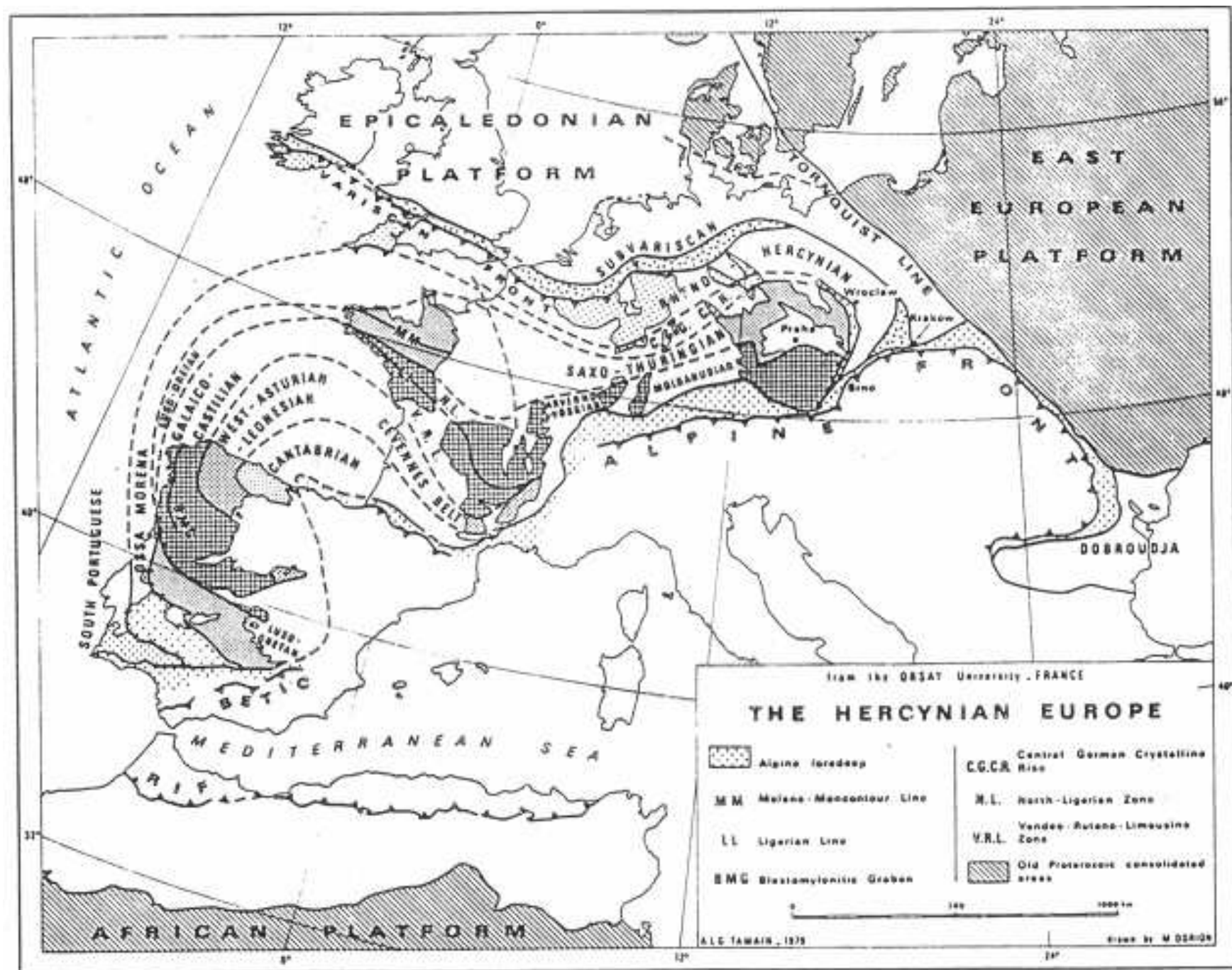
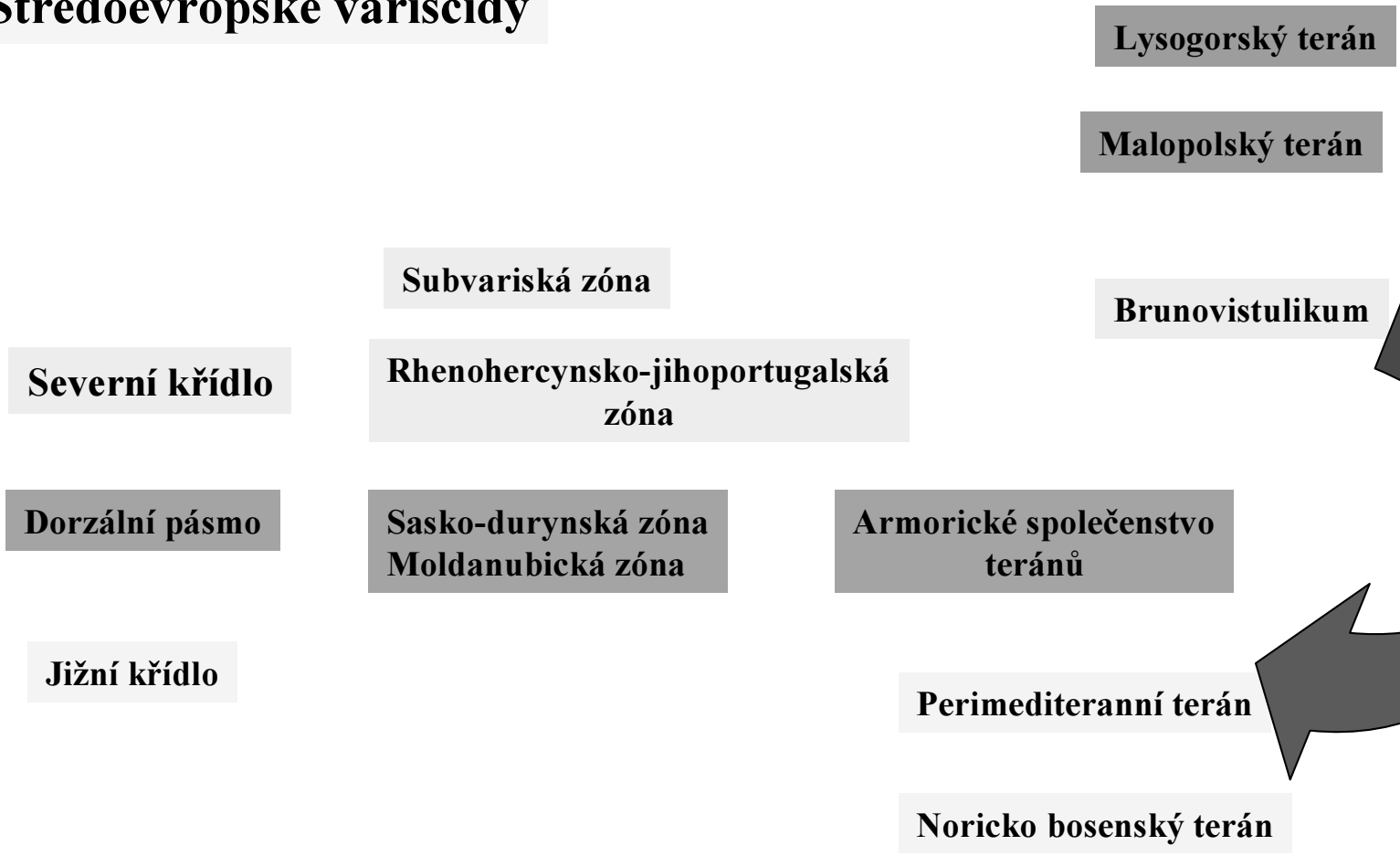
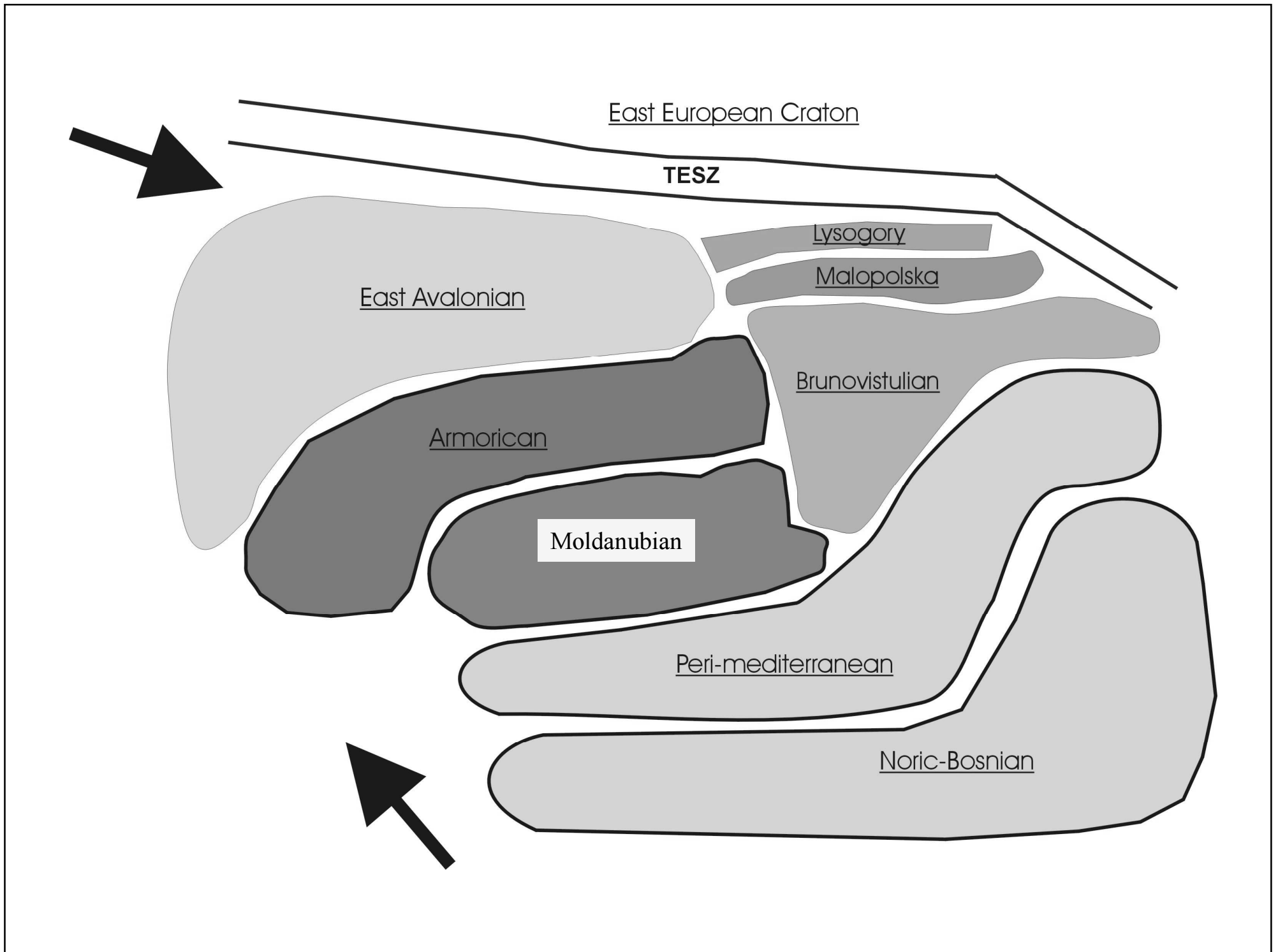
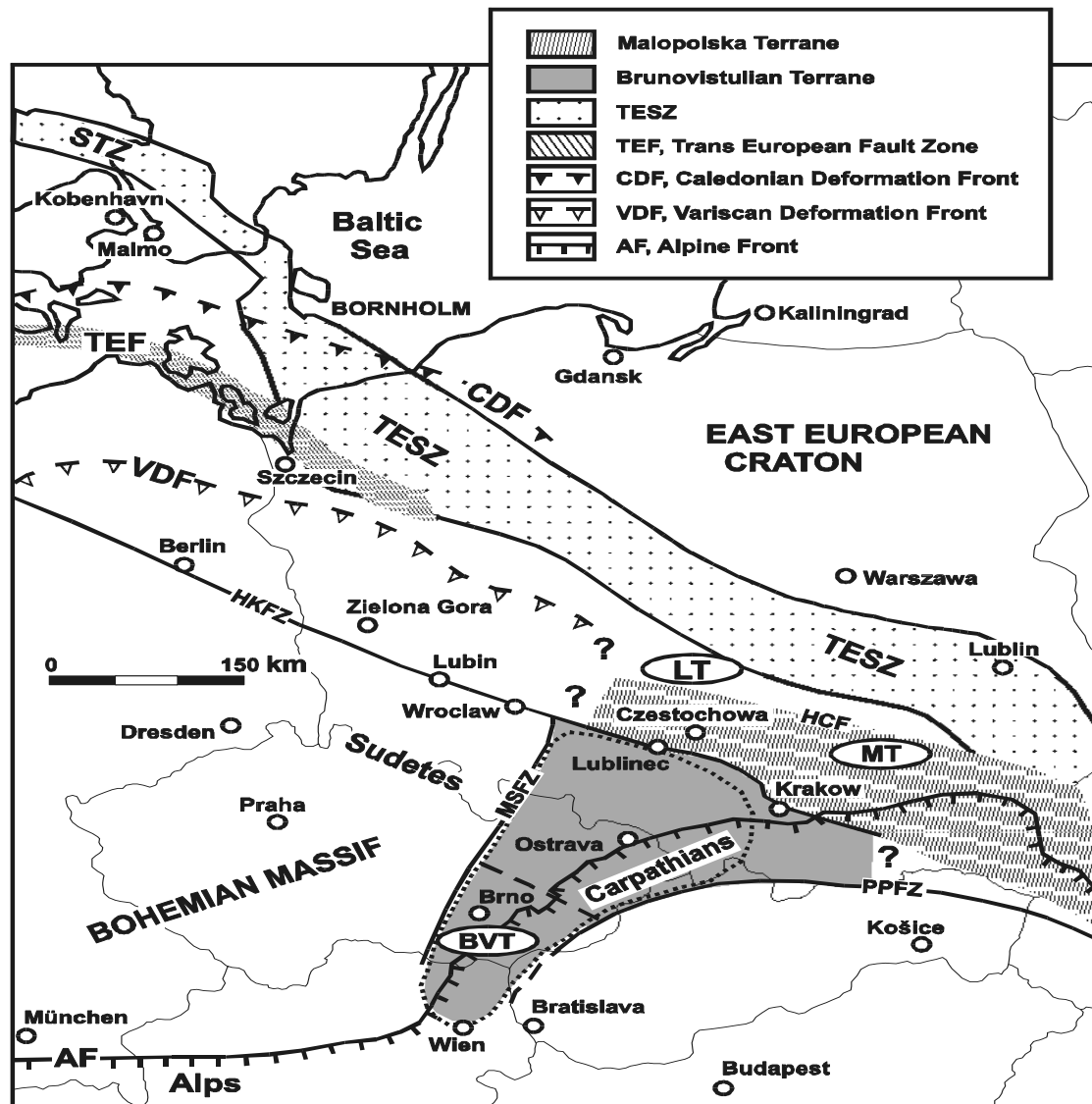


Figure 1. Map showing major zones of the Hercynian in Europe.

Středoevropské variscidy







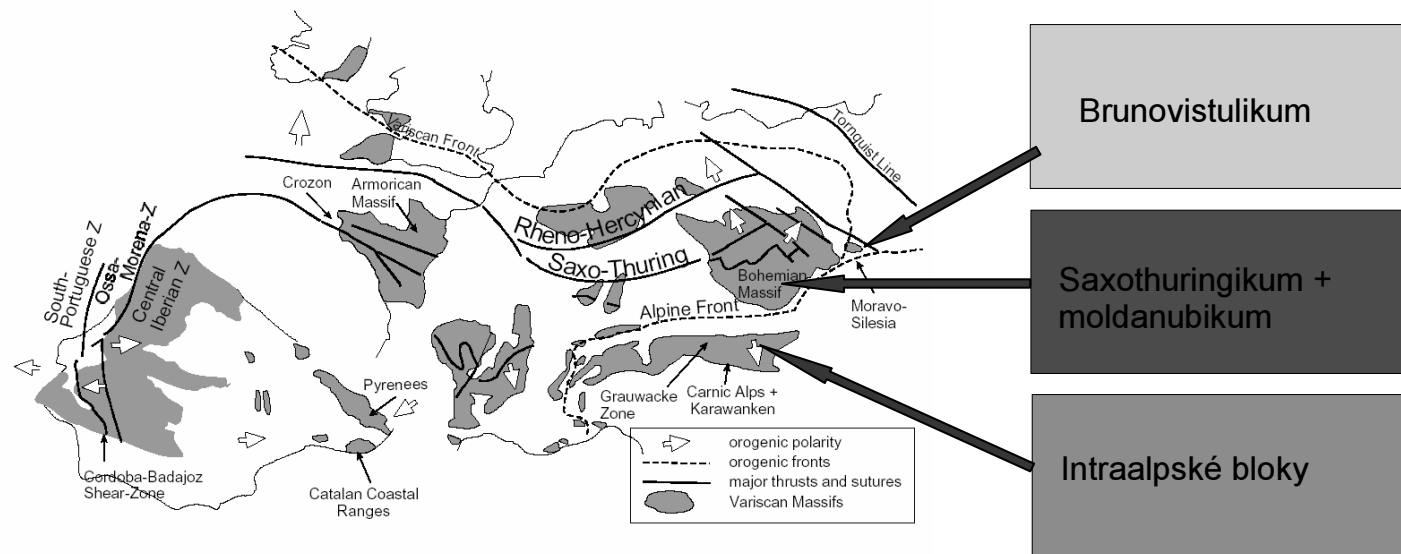
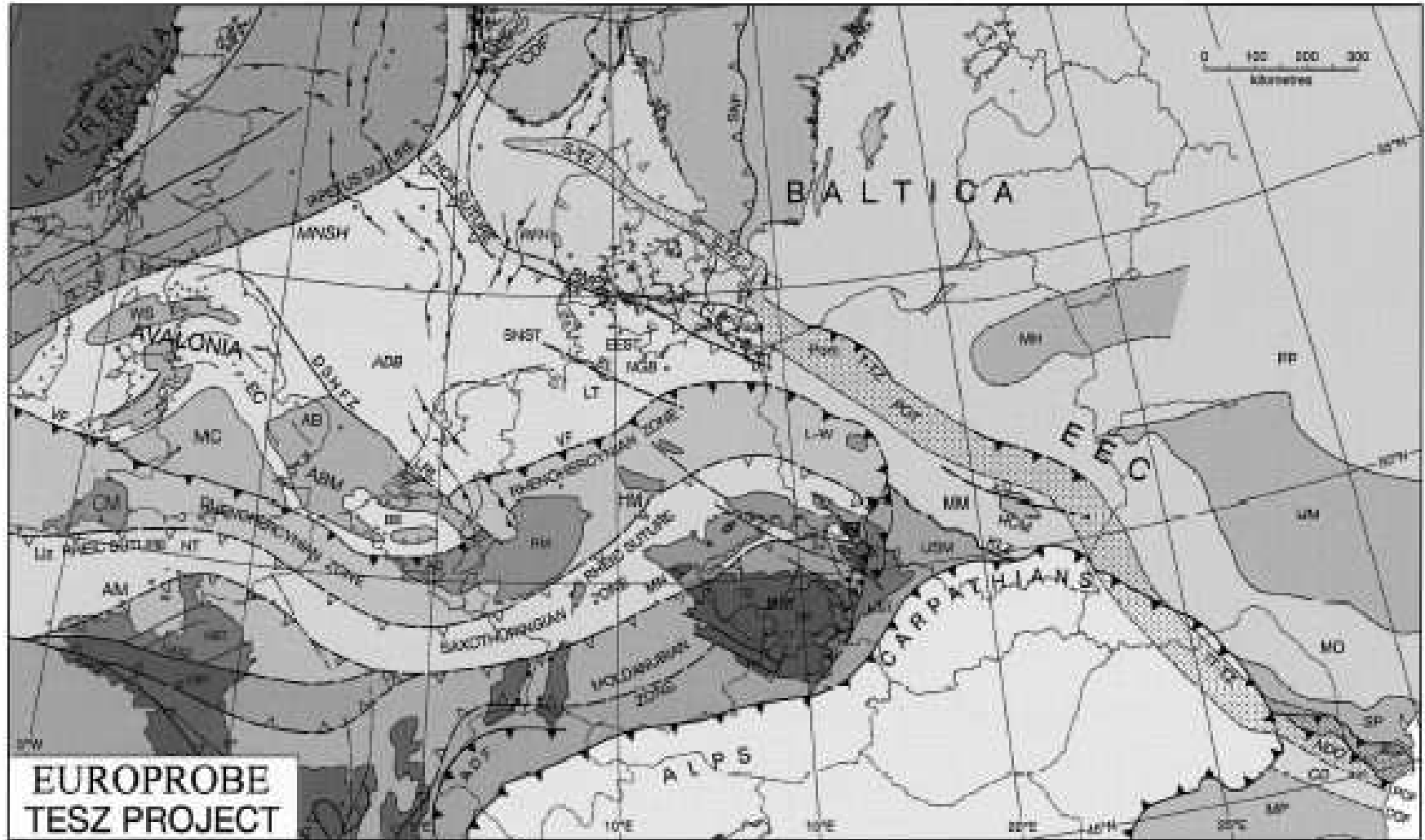


Figure 2: Main structural elements of the European Variscan fold belt.



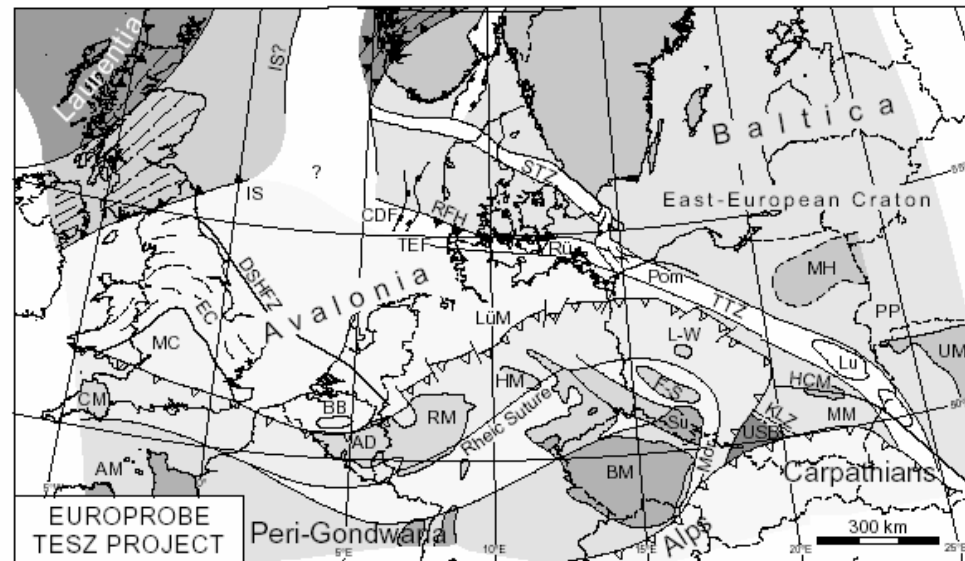


Figure 4.1: Basement tectonic sketch map of the TESS and adjacent areas, slightly modified from Berthelsen (1994), in EUROPROBE Newsletter 5. The Central Polish Trough is located at the position of the letters TTZ on this map. Key: AD, Ardennes; AM, Armorican Massif; BB, Brabant Massif; BM, Bohemian Massif; C, Cadomia; CDF, Caledonian Deformation Front; CM, Cornubian Massif; DSHFZ, Dowling-South Hewett Fault Zone; EC, Eastern English Caledonides; EEC, East-European Craton; F-S, Fore-Sudetic Block; HM, Harz Mountains; HCM, Holy Cross Mountains; IS, Iapetus Suture (Avalonia-Laurentia); IS?, uncertain location of Laurentia-Baltica Suture; KLZ, Kraków-Lubliniec Zone; Lu, Lublin Trough; LuM, Lüneberg Massif; L-W, Leszno-Wolsztyn Basement High; MC, Midlands microcraton; MH, Mazurska High; MM, Matopolska Massif; Mor, Moravia; Pom, Pomerania; PP, Pripyat Trough; RFH, Ringkøbing-Fyn High; RM, Rhenish Massif; Ru, Rügen Island; STZ, Sorgenfrei-Tornquist Zone; Su, Sudetes Mountains; TEF, Trans-European Fault Zone; TTZ, Teisseyre-Tornquist Zone; UM, Ukrainian Massif; USB, Upper Silesian Coal Basin.

Severní křídlo variscid - charakteristika

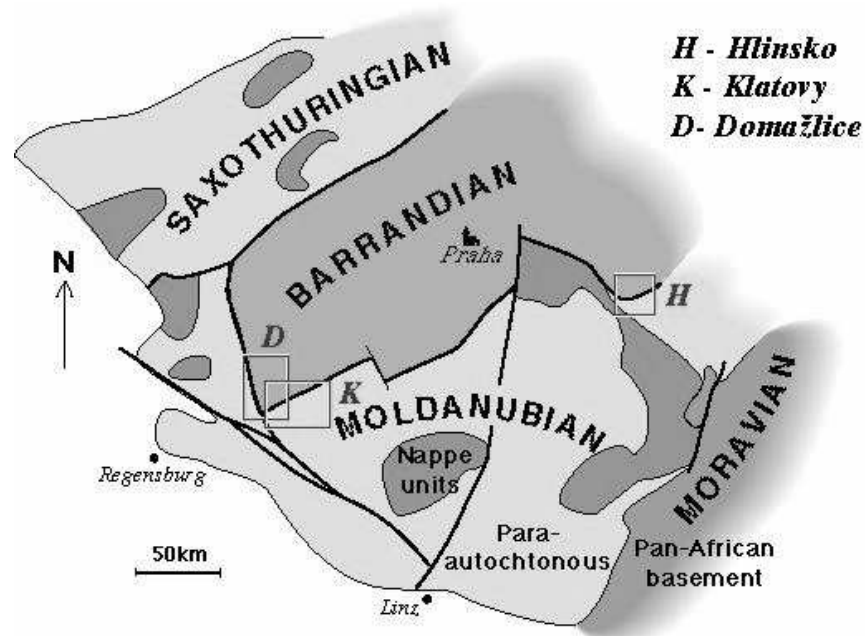
Subvariská zóna – dozvuky variského vrásnění – slabě zvrásněné nebo nezvrásněné sedimenty.
Molasové paralické uhelné pánve

Renohercynské-jihoportugalská zóna – extenzní zóna variské kolize (devon-spod. karbon),
Okraj Avalonie, brunovistulika, příkrovová stavba, bimodální vulkanismus, slabá
nebo žádná metamorfóza, typický flyš (kulm)

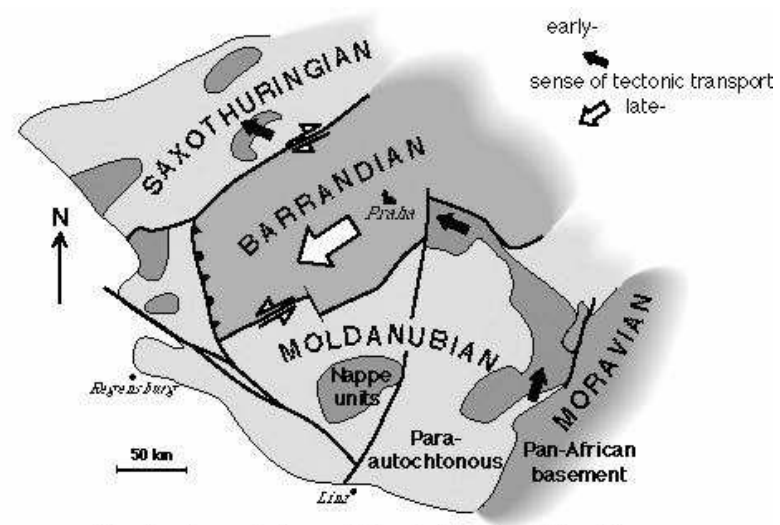
Středoněmecký krystalinický práh – metamorfované svrchnoproterozoické-ordovické
sedimenty a vulkanity, původně okraj terány saxothuringika. Od renohercynské
zóny oddělen fylitovou zónou

Sasko-durynská zóna – značná metamorfóza a grantizace slábnoucí k severu, postorogenní
plutonismus. Počátek vrásnění v spodním devonu, hlavní fáze spodní karbon.
Divolý flyš – devon-sp, karbon. Terán saxothuringika oddělen od moldanubika
ebersdorfskou linií (litoměřický zlom), marianskolázeňský ultrabazický komplex

Moldanubická zóna – intenzivní metamorfóza, grantizace a plutonismus. Hlavně devonské fáze
vrásnění. Moldanubický terán (Perunica). Na západě a severu tekton. Kontakt s
saxothuringikem, na jihu s perimediterránním teránem a na východě s brunovistulikem

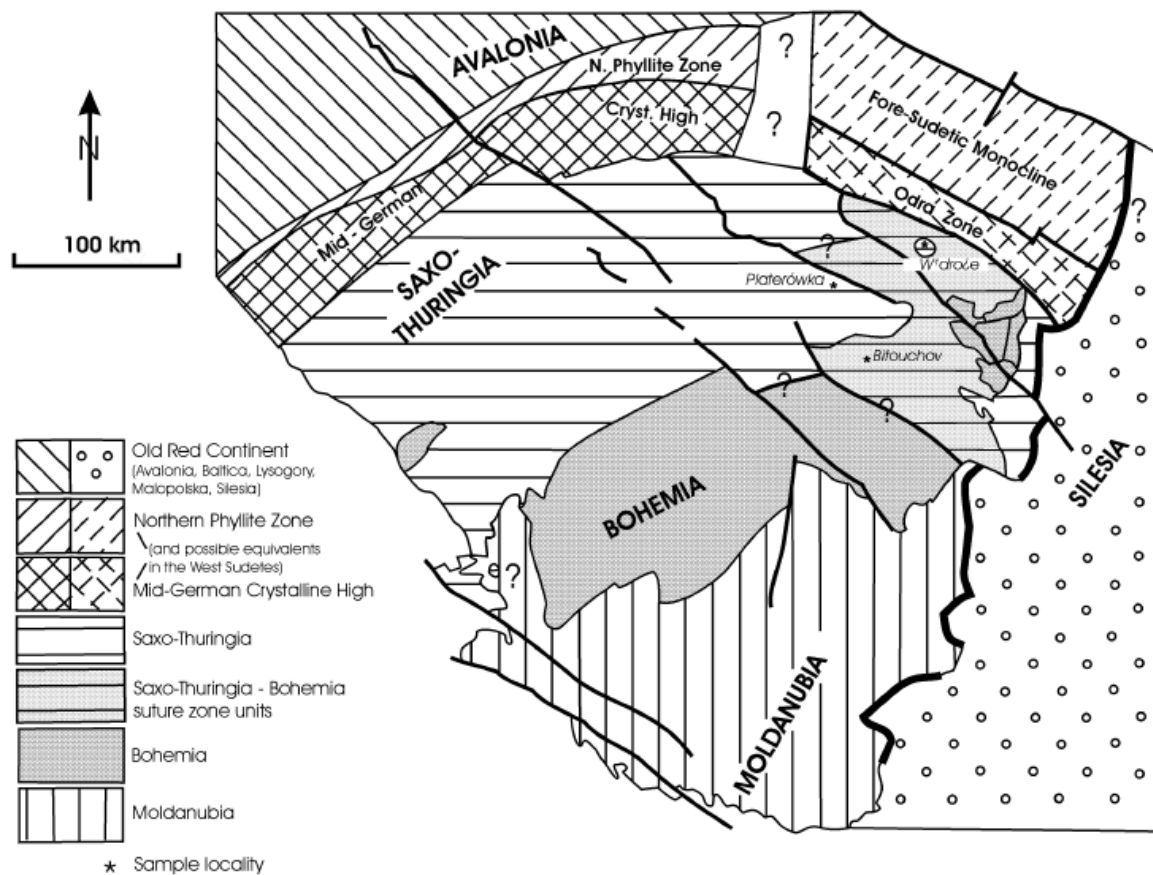


Sketch of the Bohemian Massif



Tectonic evolution of the Bohemian Massif
 and the juxtaposition of the Barrandian & Moldanubian blocks

Fig. 7 Schematic structural map of terranes in the Bohemian Massif



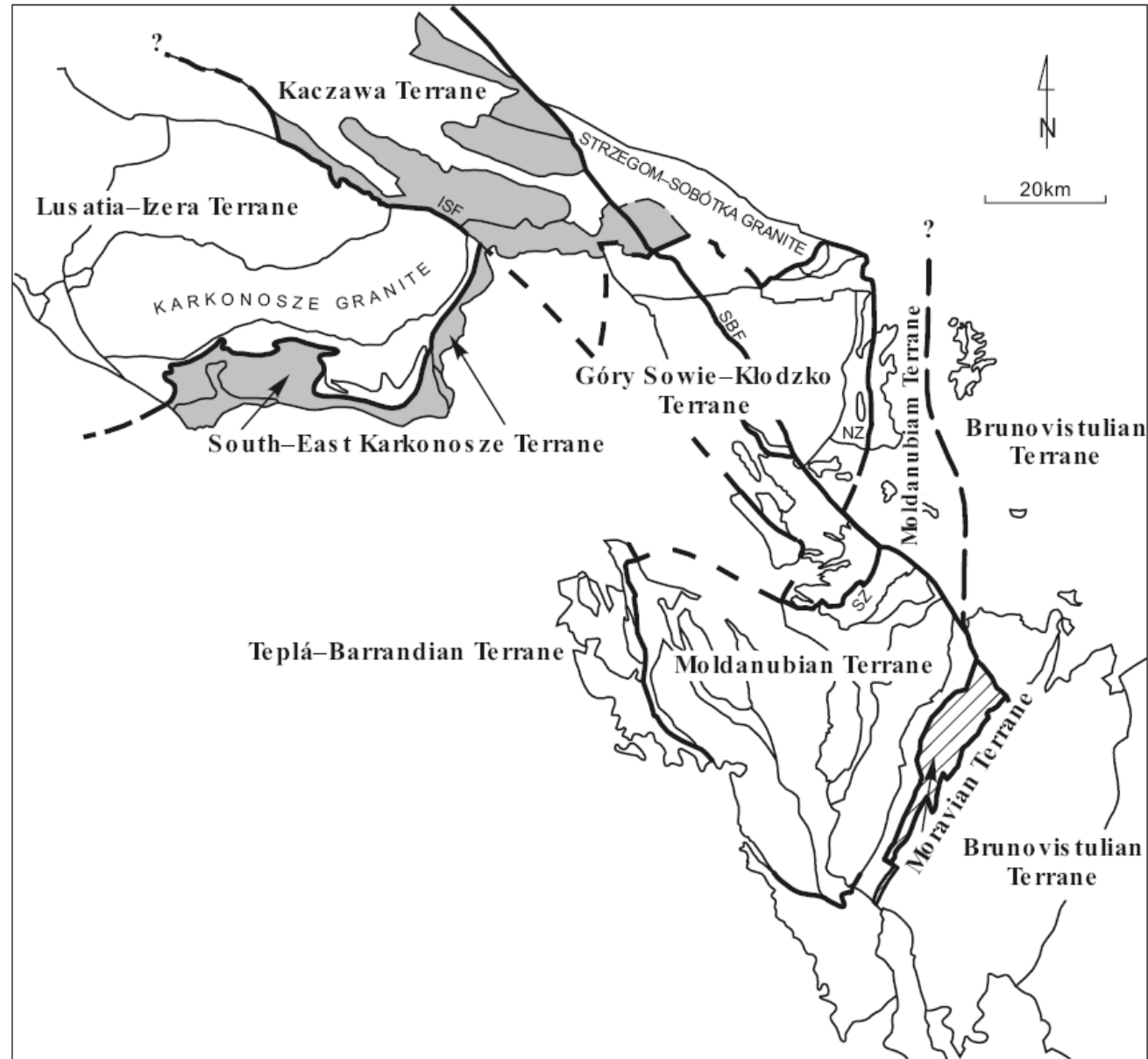


Fig. 7. Tectonostratigraphic terranes in the Sudetes (after Aleksandrowski & Mazur, 2002). ISF — Intra-Sudetic Fault, NZ — Niemcza Shear Zone, SBF — Sudetic Boundary Fault, SZ — Skrzynka Shear Zone.

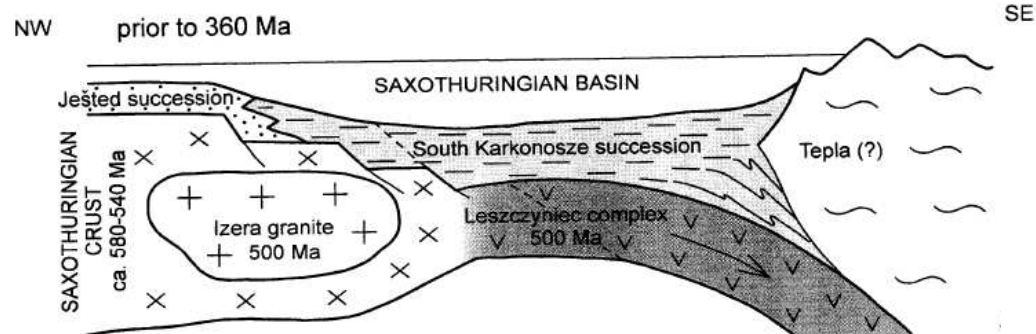
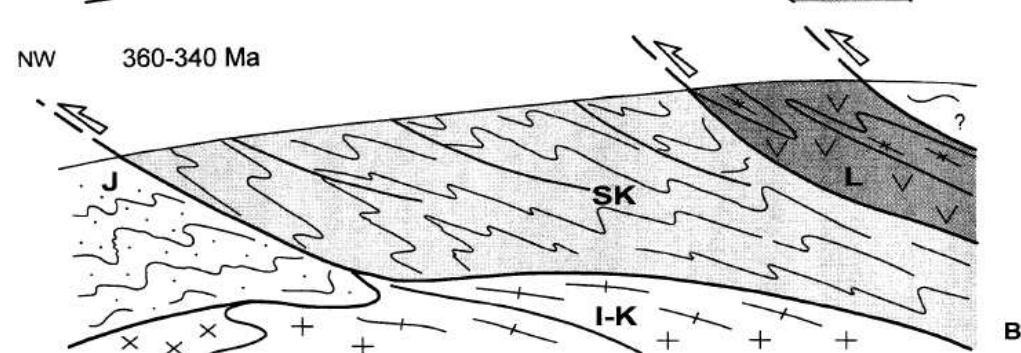


Fig. 9 Late Devonian to Carboniferous structural evolution of the Karkonosze-Izera massif leading to formation of a suture zone and inverted metamorphic nappe pile (vertically exaggerated schematic model). **A** Schematic palinspastic restoration of the Karkonosze-Izera nappe units prior to the main overthrusting event (Middle Devonian) inspired by Wolfgang Franke's



reconstructions of the Saxothuringian belt. **B** Late Devonian to early Viséan NW-ward overthrusting event. **C** Top-to-ESE extensional collapse followed by intrusion of the Karkonosze granite during the Viséan. **I-K** Izera-Kowary unit; **J** Ještěd unit; **SK** South Karkonosze unit; **L** Leszczyńiec unit. Age assignments as in Fig. 1

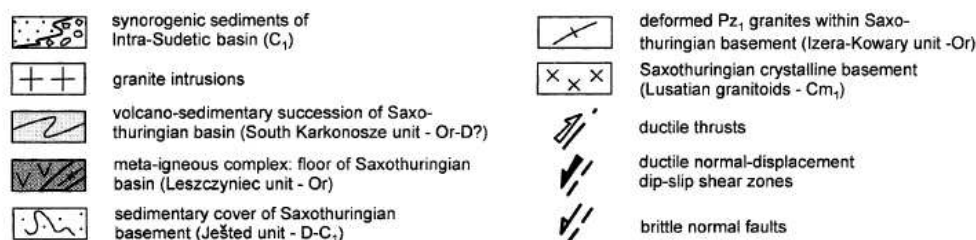
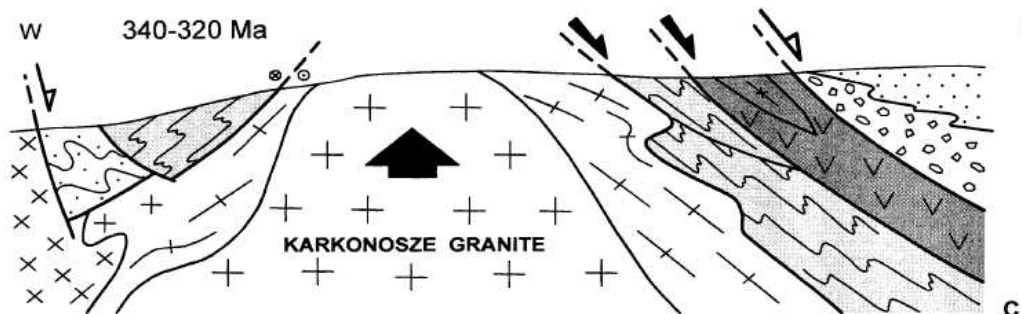
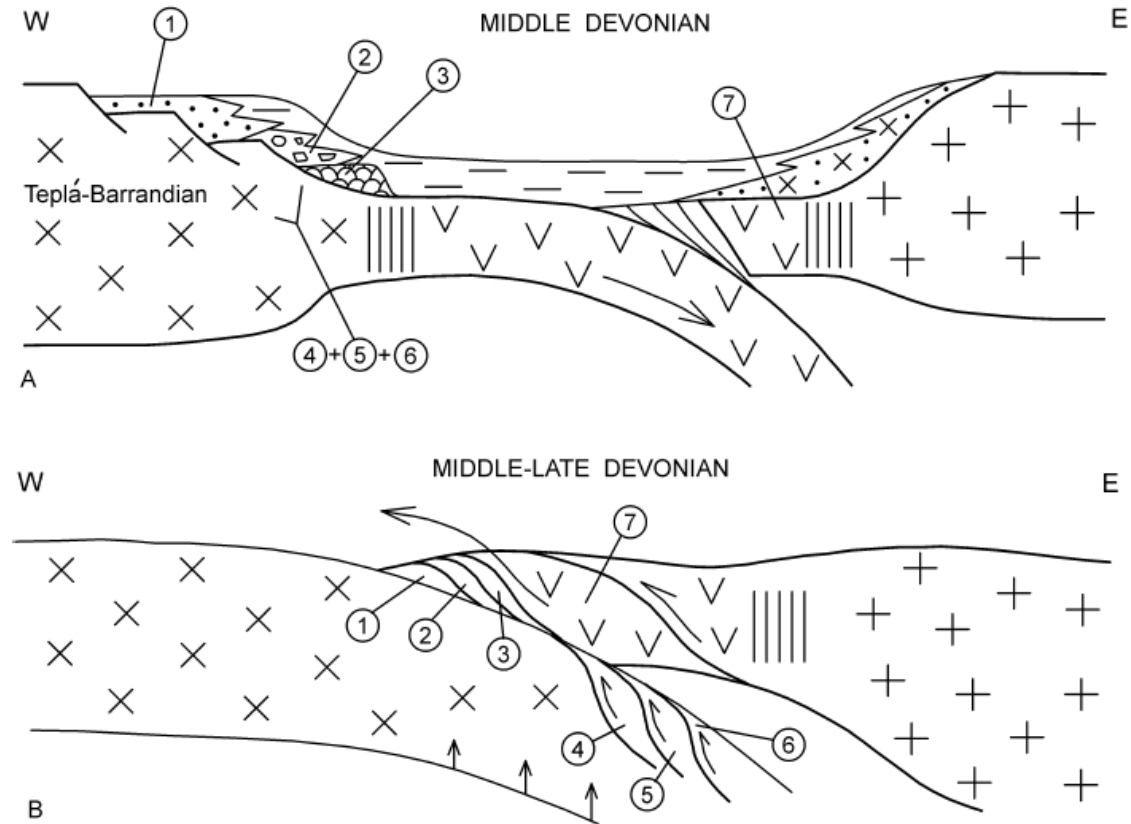


Fig. 11 Evolution of the Kłodzko Metamorphic Complex in Devonian. *1* Mały Bożków Unit; *2* Łączna Unit; *3* Bierkowice Unit; *4* Ścinawka Unit; *5* Orla-Gołogłowy Unit; *6* Kłodzko Fortress Unit; *7* Nowa Ruda Ophiolite. **A** Pre-collisional stage: protoliths of the Mały Bożków, Łączna and Bierkowice units are comprised in the volcano-sedimentary succession of the passive continental margin; **B** collisional stage: obduction of the ophiolite and subsequent nappe stacking are induced by uplift of the earlier subducted continental crust



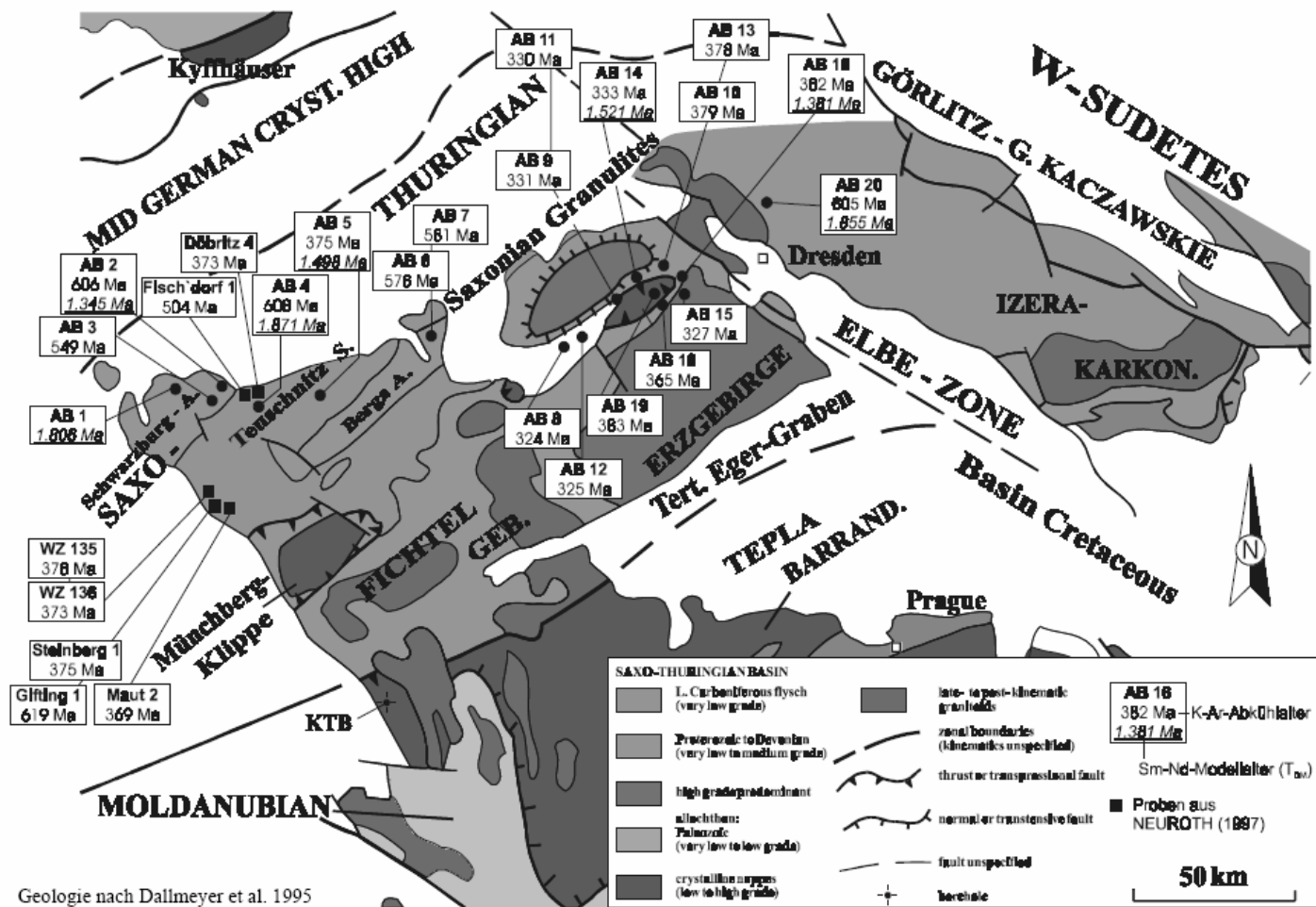


Abb. IV.23: Lage der Probennahmepunkte im Saxothuringikum mit den dazugehörigen Ergebnissen der K-Ar- und Sm-Nd-Altersbestimmungen.

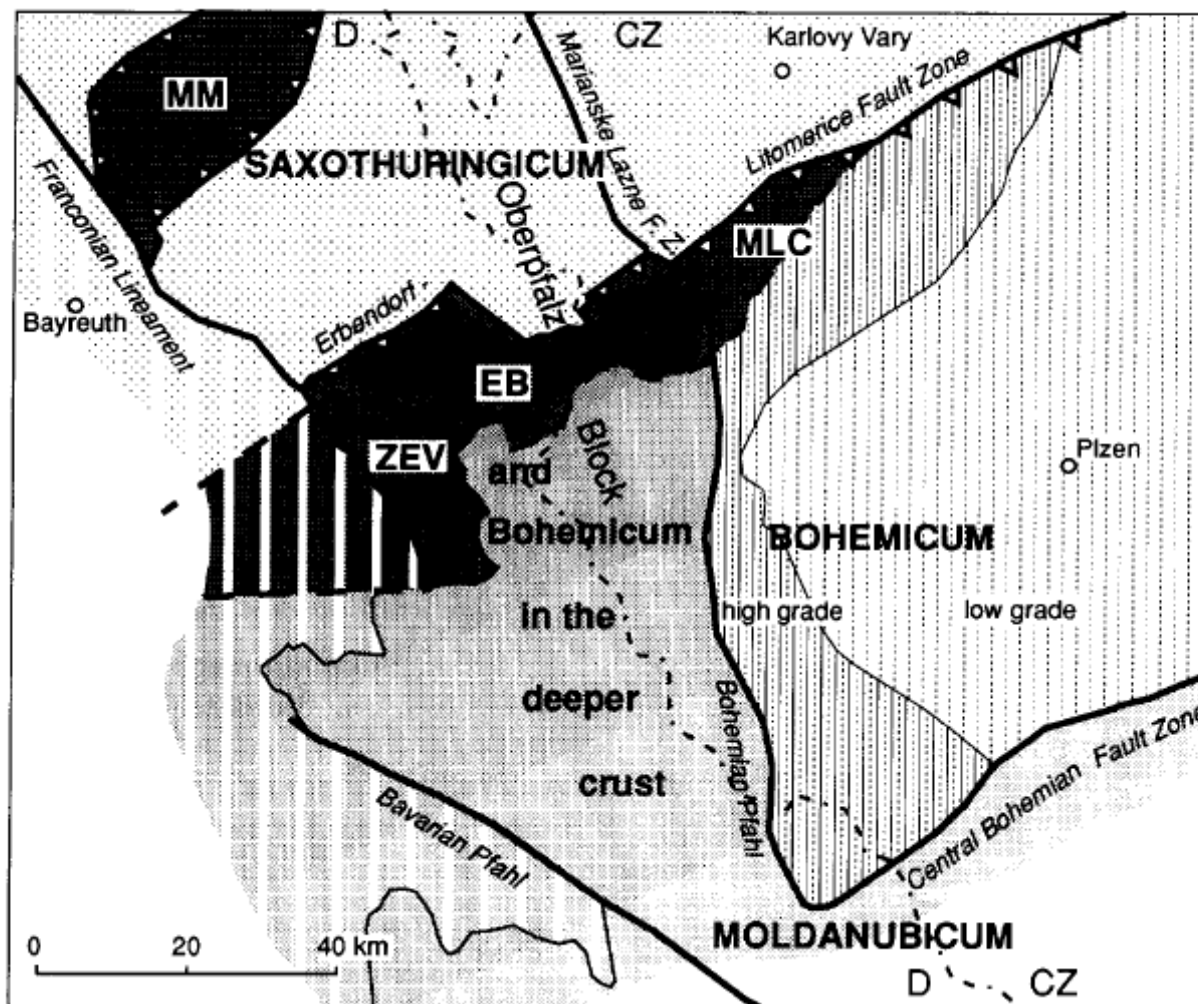
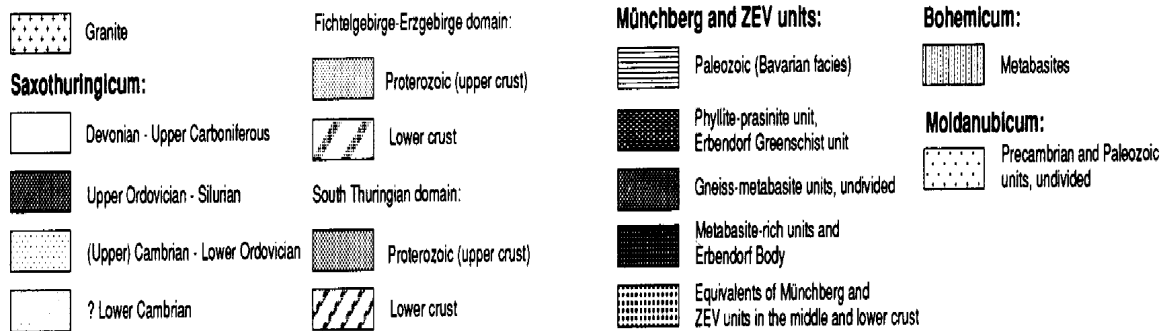
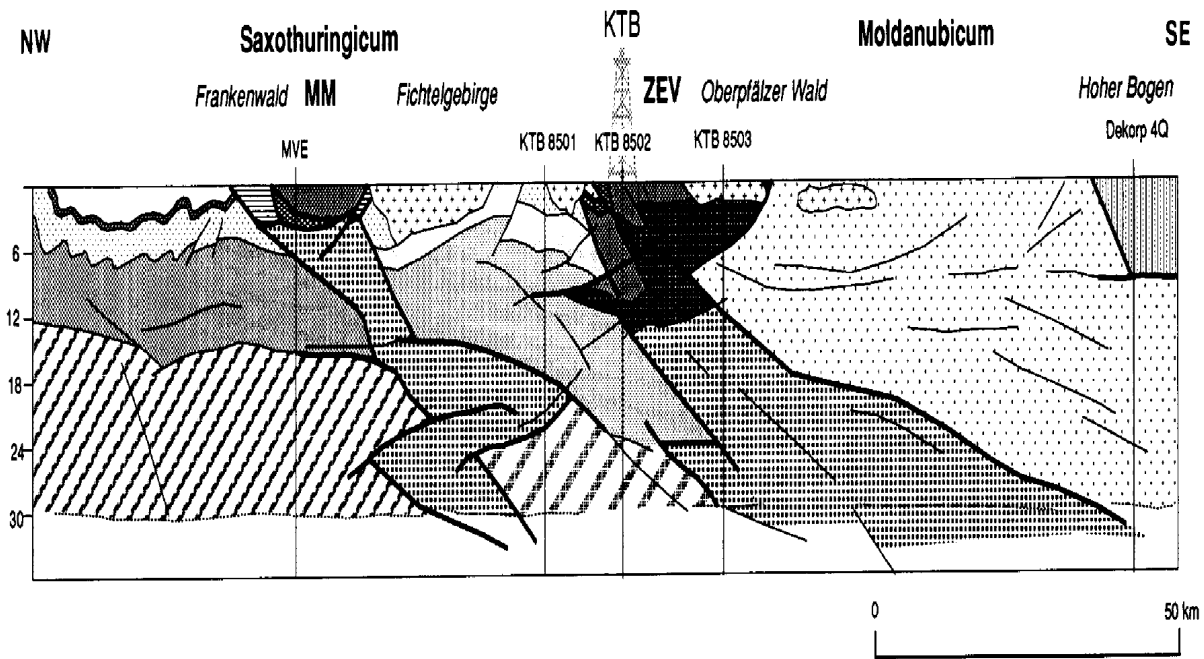


Fig. 7. Configuration of terranes at the NW edge of the Bohemian Massif (West Bohemia-Northeast Bavaria). The NW-thrusting Erbendorf-Litomeřice Fault Zone represents the terrane boundary (suture) between the Moldanubicum and Bohemium/Mariánské Lázně Complex (MLC) in the south and the Saxothuringicum in the north. It is assumed that parts of the high-grade metamorphic MLC/Bohemium complexes are buried in the deeper crust beneath the Moldanubicum of the Oberpfalz Block (Behr, 1992) west of the Bohemian Pfahl/Mariánské Lázně Fault Zone (West Bohemian Fault Zone). The highly reflective zone of the Erbendorf Body (EB) possibly represents the concealed continuation of the Mariánské Lázně Complex. MLC and ZEV are regarded as suture complexes which were exhumed from the deeper crust and which are tied up to the junction of the ENE-WSW terrane boundary with the NNW-SSE Oberpfalz Block.



G. Hirschmann / Tectonophysics 264 (1996) 327-339

Fig. 8. Tentative geological cross-section following the seismic profile DEKORP 4. The presented interpretation assumes the existence of two sutures: a suture separating the Moldanubicum (and Bohemicum) from the Saxothuringicum, with equivalents of the Mariánské Lázně Complex (Erbendorf Body) and Bohemicum in the deeper crust, and with the ZEV on top of it, and an intra-Saxothuringian suture between the Fichtelgebirge-Erzgebirge domain and the South Thuringian domain, with the shallow nappe-structure of the Münchberg Massif (MM) on top of it. For further explanation see text and Fig. 7

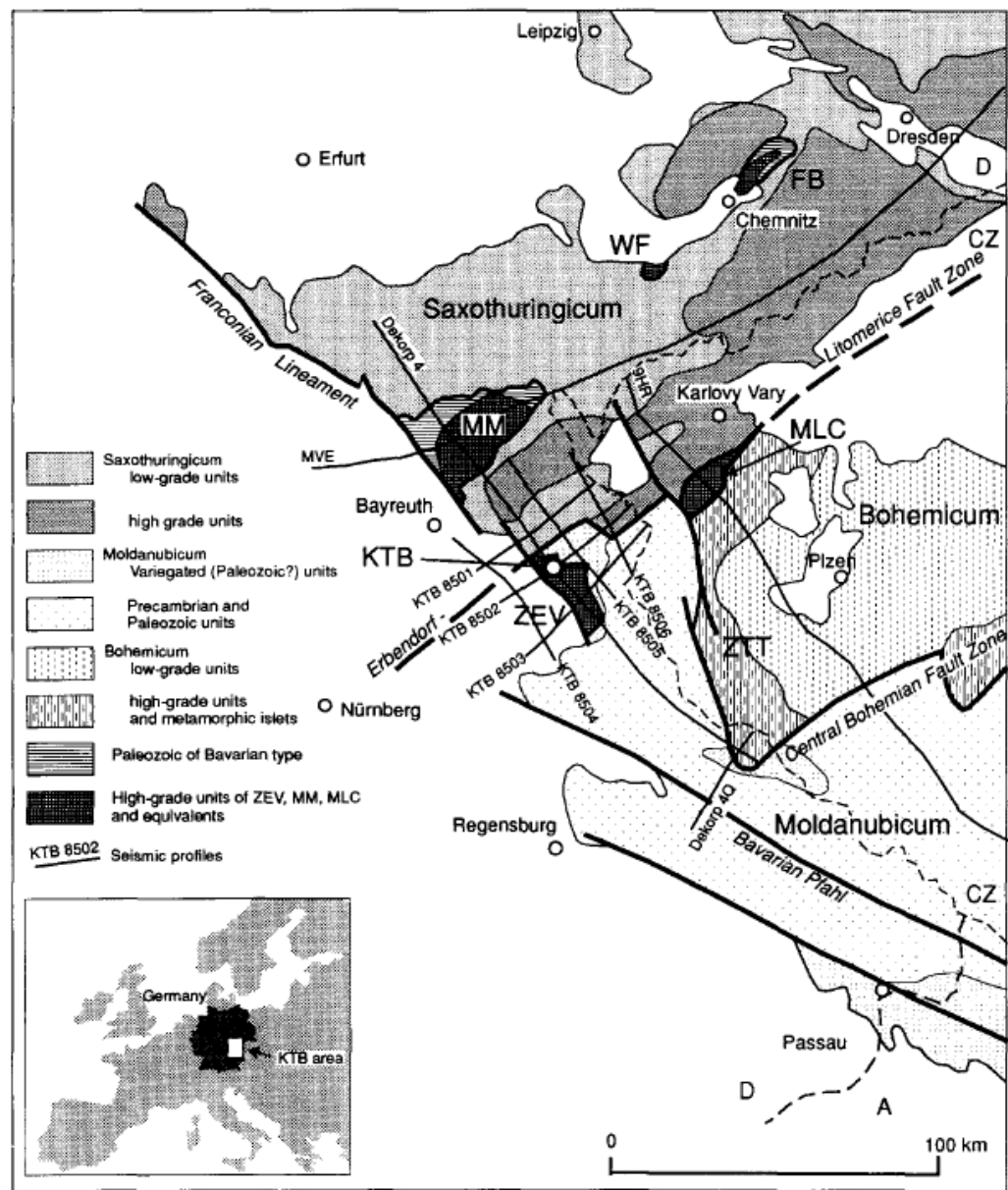
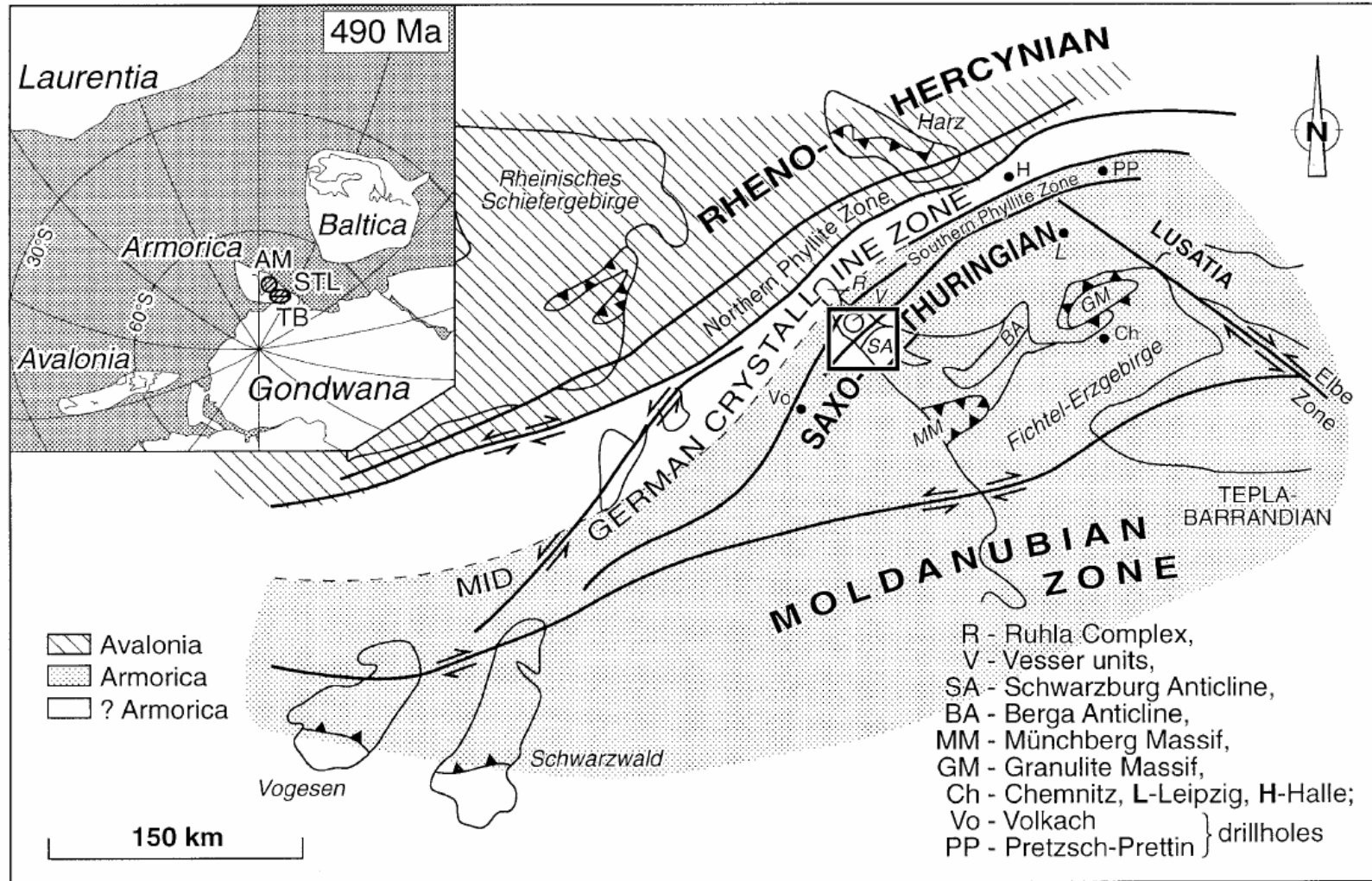


Fig. 1. Tectonometamorphic units (terranes) in the western part of the Bohemian Massif (Germany and Czech Republic) and the position of deep seismic profiles. *FB* = Frankenberg unit, *KTB* = KTB-location, *MLC* = Mariánské Lázně Complex, *MM* = Münchberg Massif, *WF* = Wildenfels unit, *ZEV* = Zone Erbendorf-Vohenstrauß, *ZIT* = Zone Teplá-Domažlice (Tepl-Taus). Bold lines represent Variscan and post-Variscan fault zones of regional importance (without distinction).

Severní křídlo variscid v Německu



Franke, W., 1989

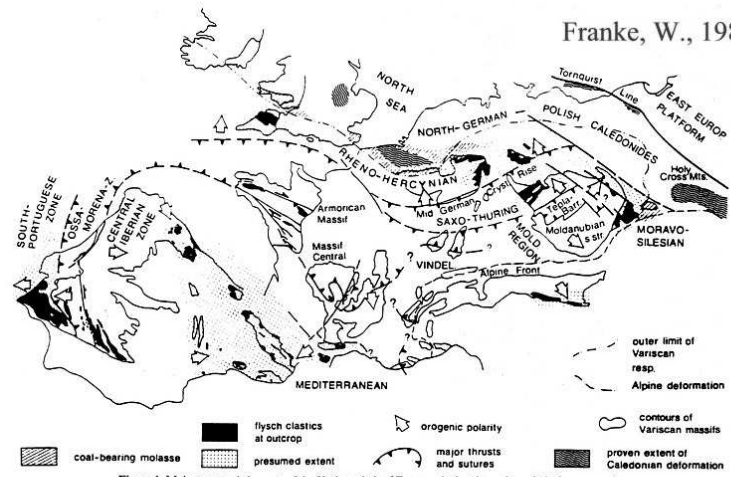


Figure 1. Main structural elements of the Variscan belt of Europe, during the main period of synorogenic clastic sedimentation (lower Carboniferous). The presumed extent of synorogenic clastics is marked only for foreland basins (stipple). After Franke and Engel, 1986.

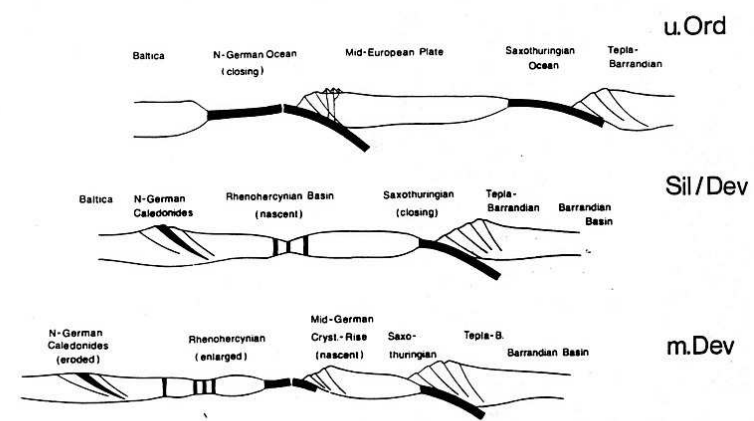
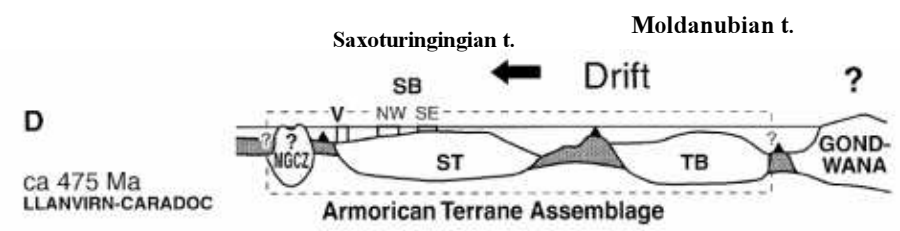
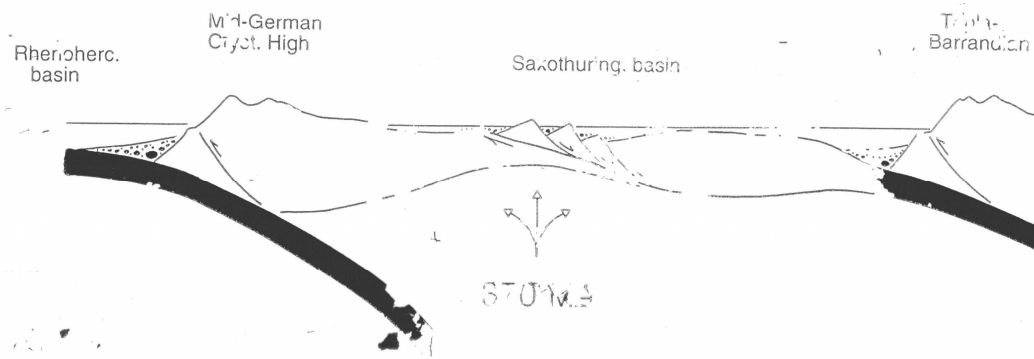
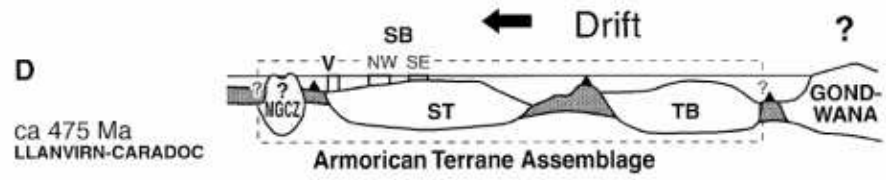


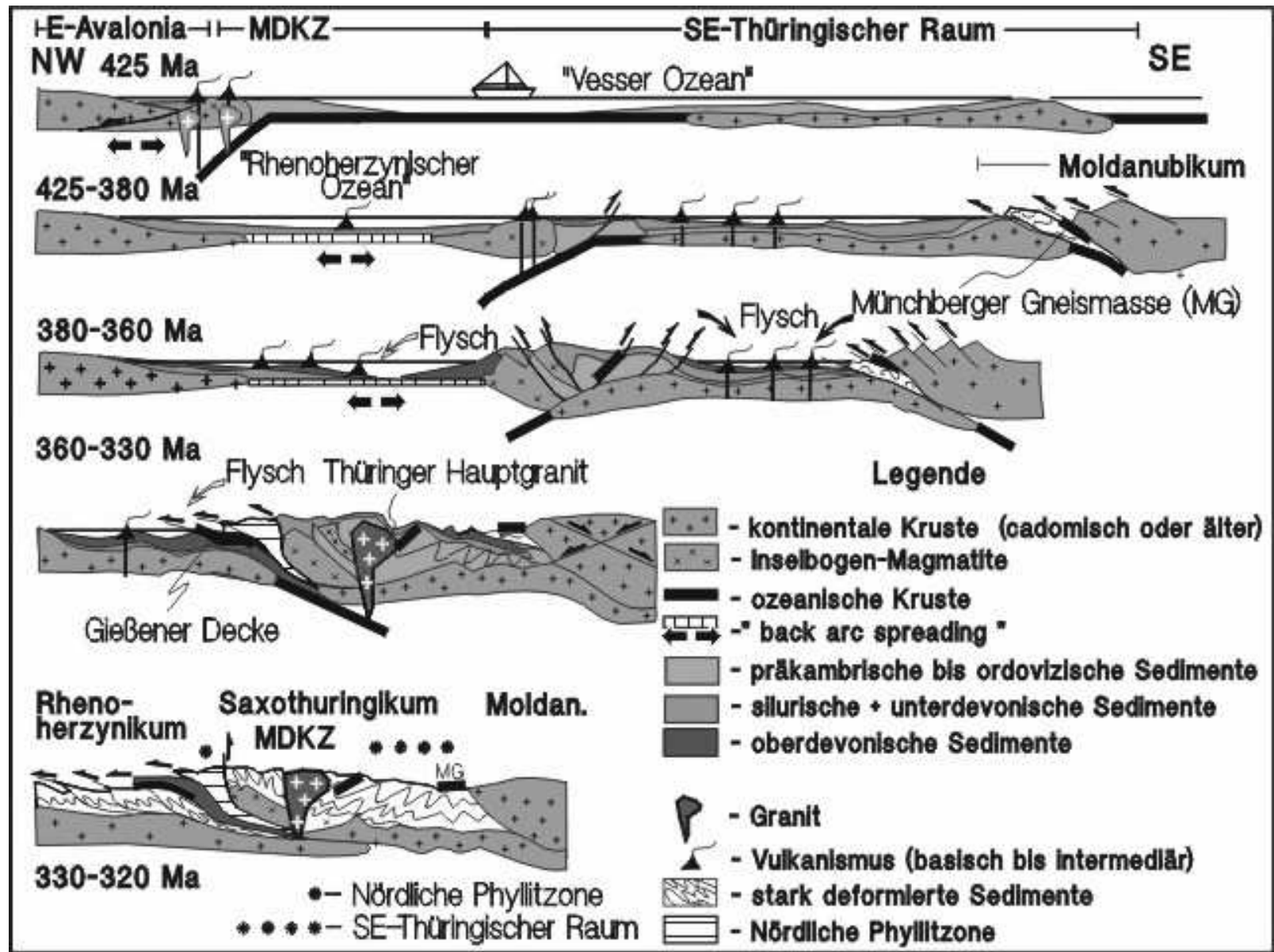
Figure 7. Plate-tectonic model for the northern flank of the Variscan belt. The final stage of collision and the northward subduction on the southern flank of the belt are not shown.

Avalonic

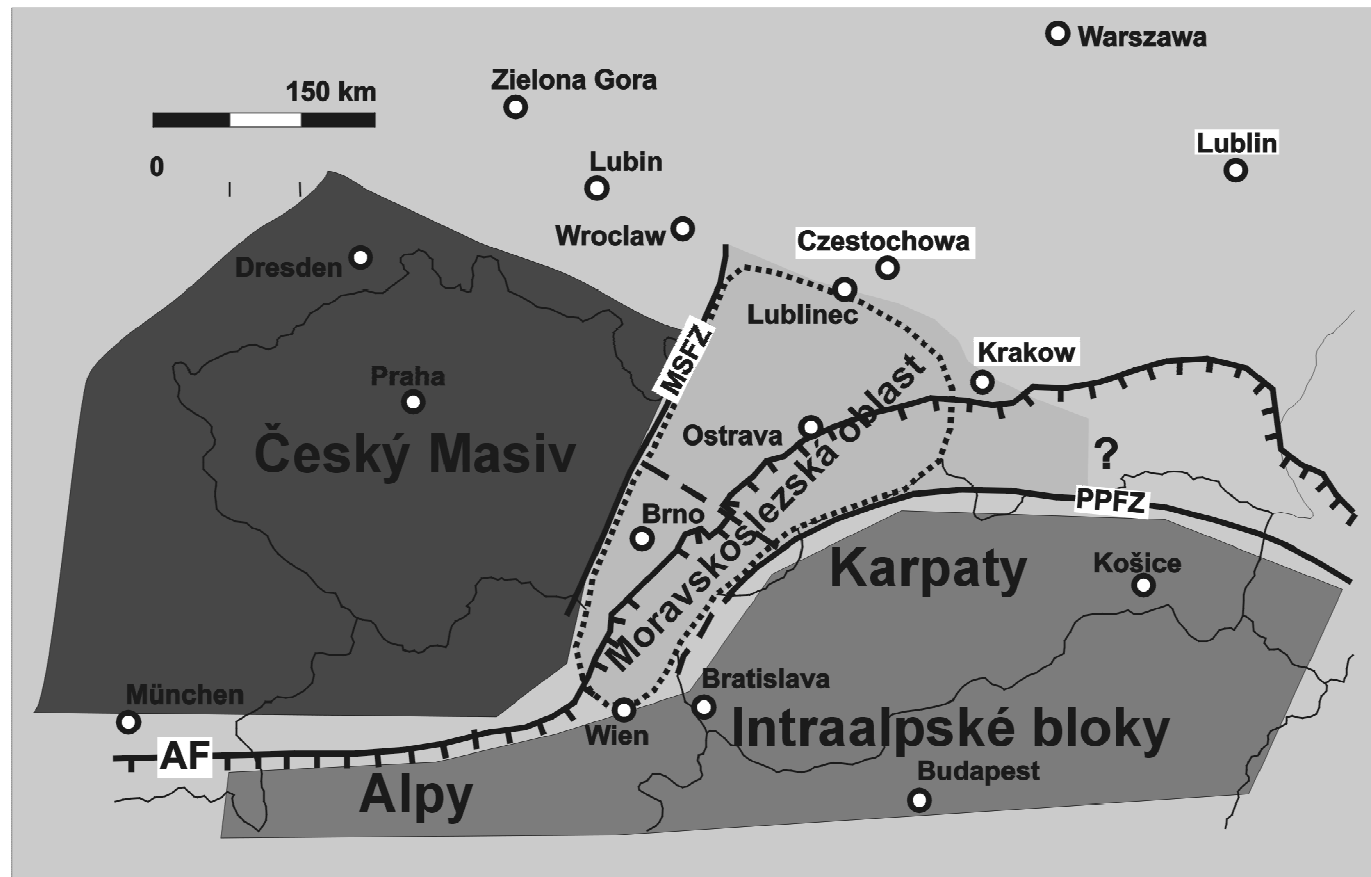


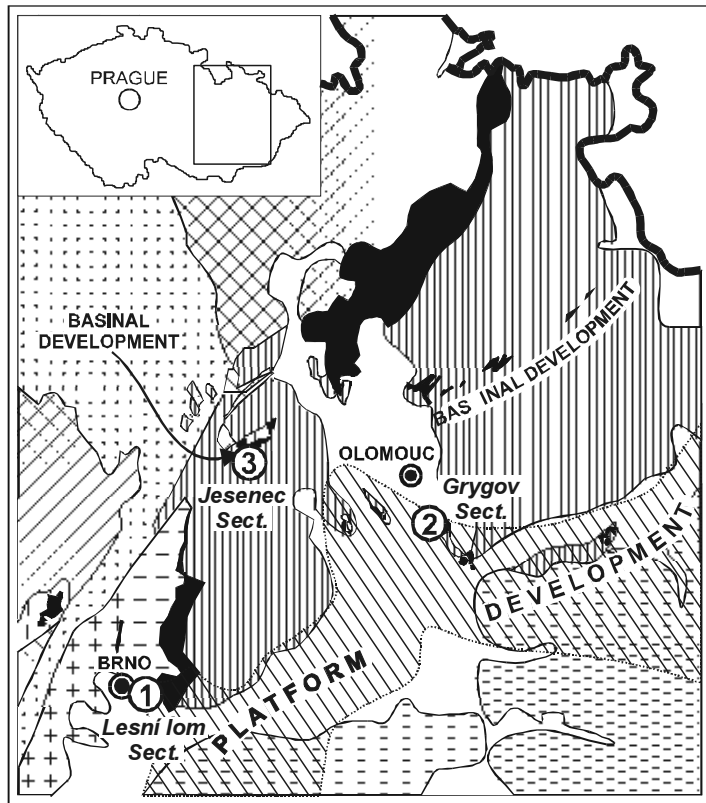


The Rhine Massif (ca. 370 Ma): Rheo-Thuringian subduction, Saxo-Thuringian basin expansion and subduction under the Terra-Barrandica. From [reference], in GALLMEYER et al., in press.













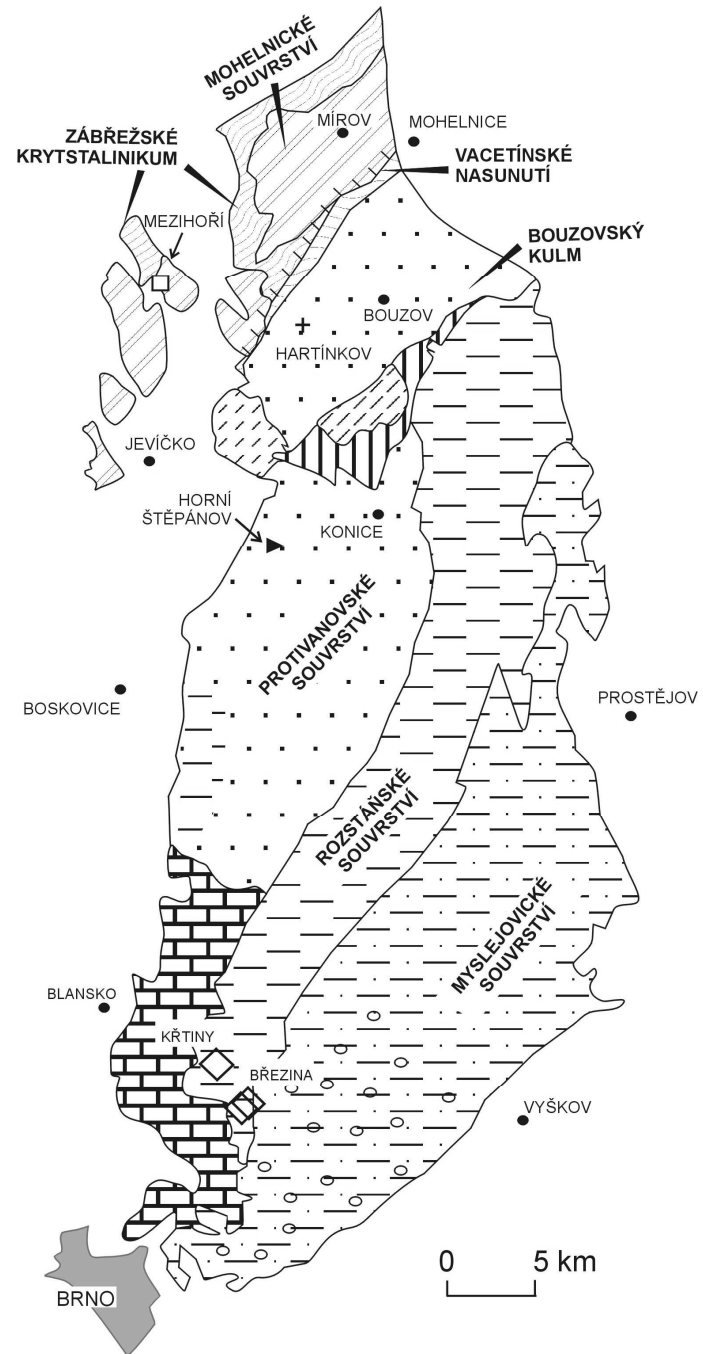
Variscidy na Moravě





LEGEND:

- | | | | |
|---|---|---|---|
|  | Brunovistulian terrane (Laurussian basement) |  | Western Carpathians flysch |
|  | Variscan crystalline rocks |  | Neogene - Quaternary cover |
|  | Devonian - Lower Carboniferous pre-flysch rocks |  | Hypothetical subsurface limit of Platform Development |
|  | Lower Carboniferous flysch (Culm facies) |  | Section locations |
|  | Permian - Cretaceous sedimentary cover |  | Major city |



SPODNÍ DEVON

brunovistulikum

lugodanubikum

Rheický oceán

počáteční fáze riftingu - bazální klastika



STŘEDNÍ DEVON

drahansko-hornobenešovská
pánev

ludmirovská pánev

pánev Moravského krasu



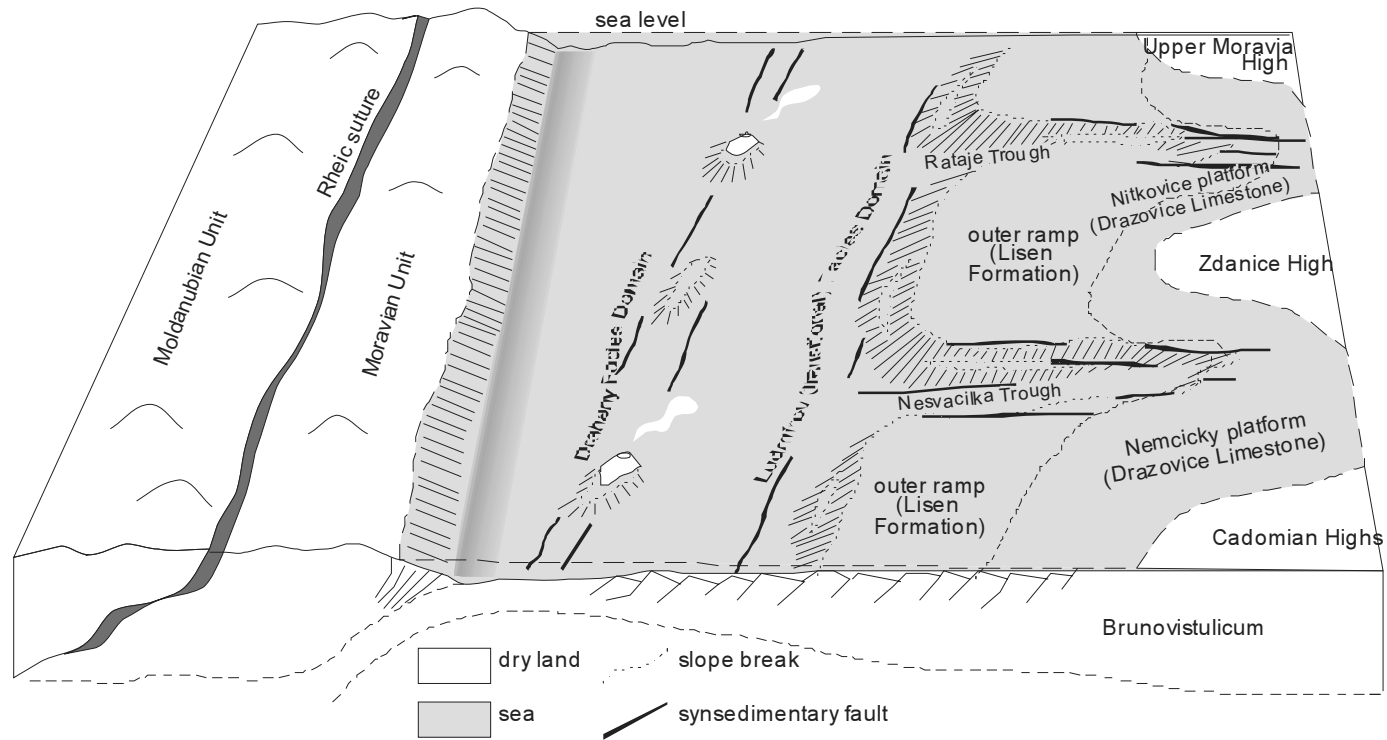
SVRCHNÍ DEVON

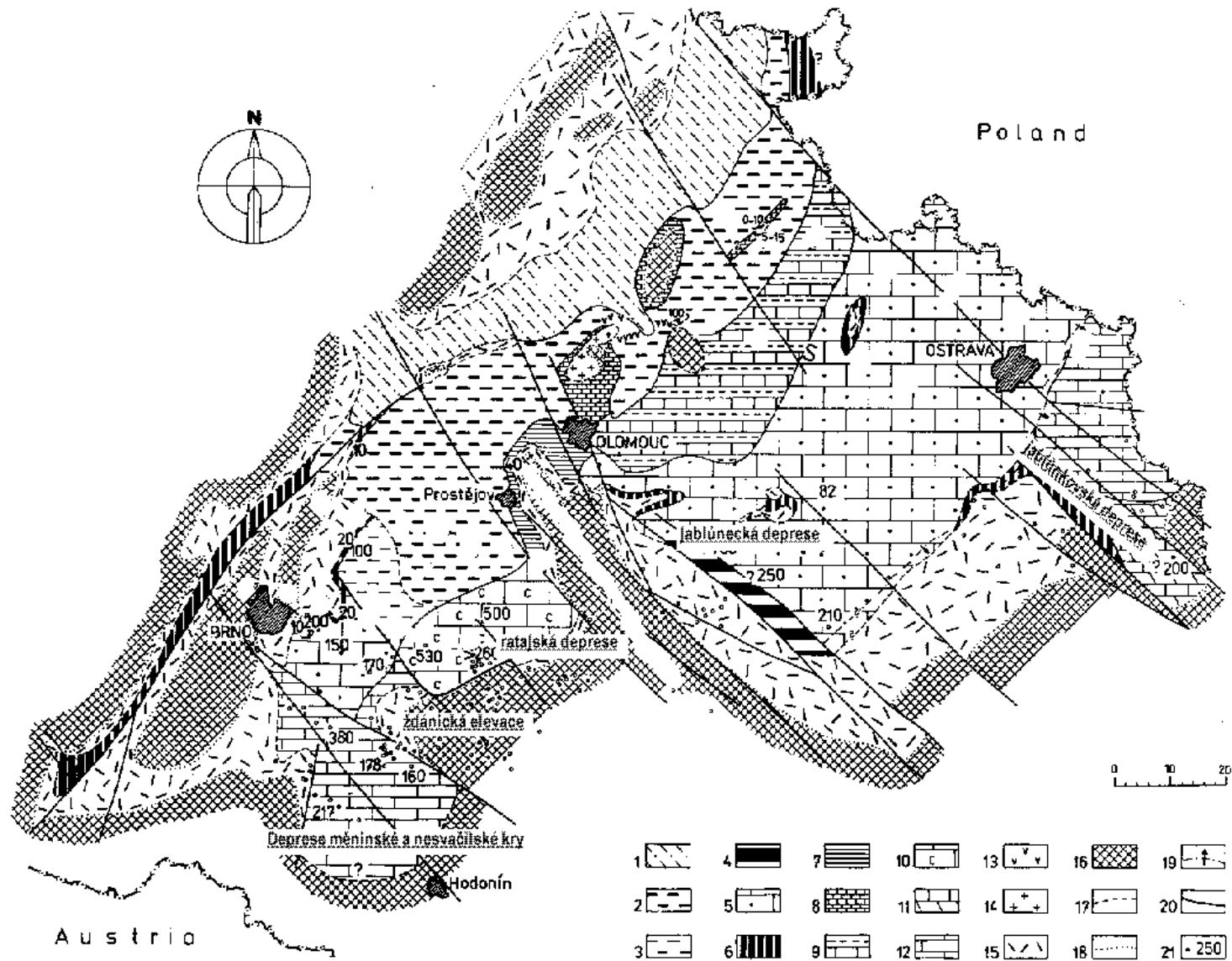
mirovský flyš

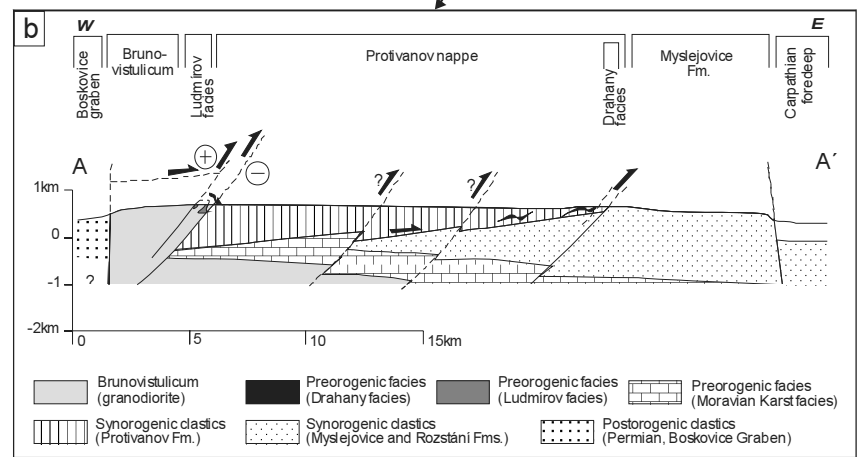
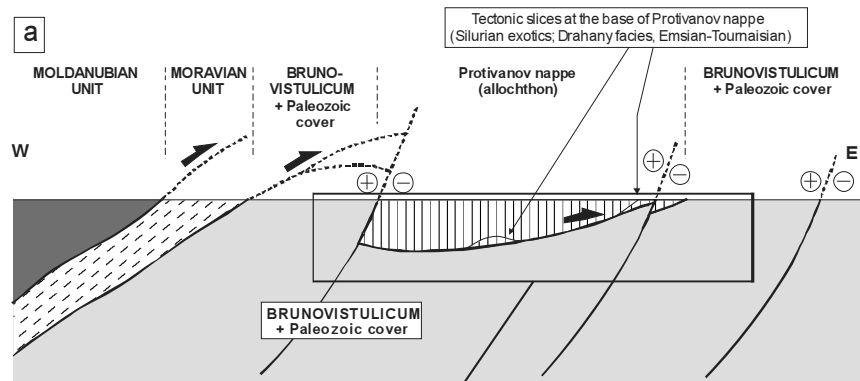


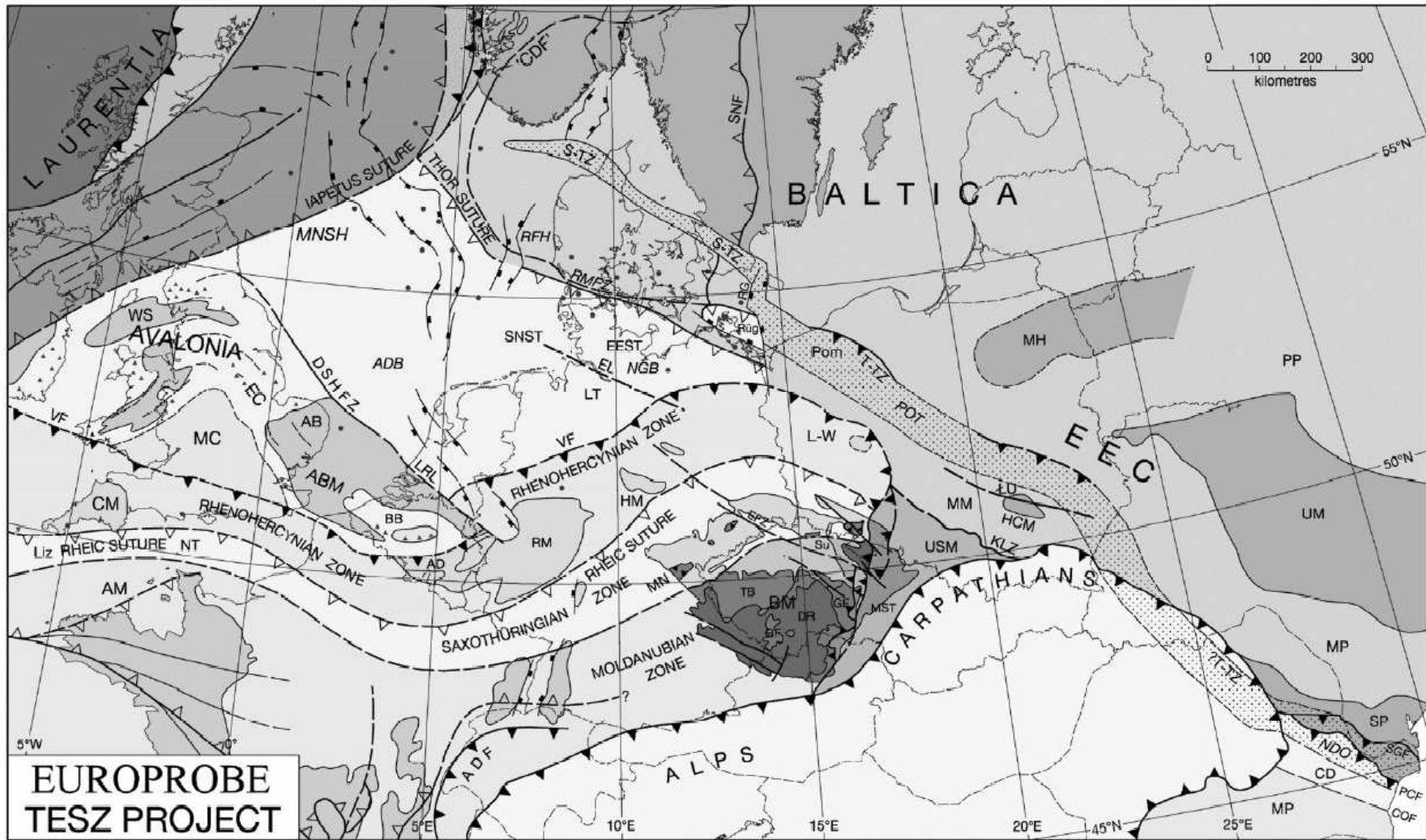
Obr. 47. Model vývoje devonských transtenzních pánví na brunovistulickém jižním okraji Laurusie.

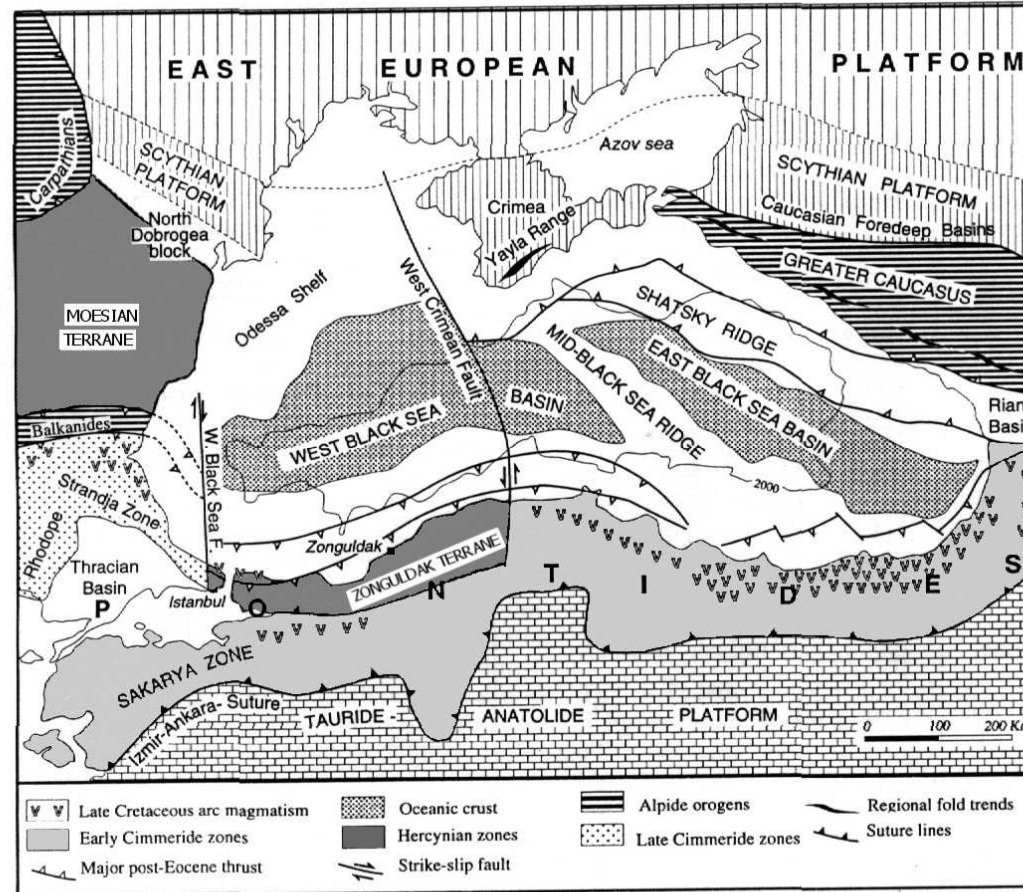
nědeřím břidlic s nalebami radiolaritů, místy i s vločkami kalciturbiditů. Největší rozšíření



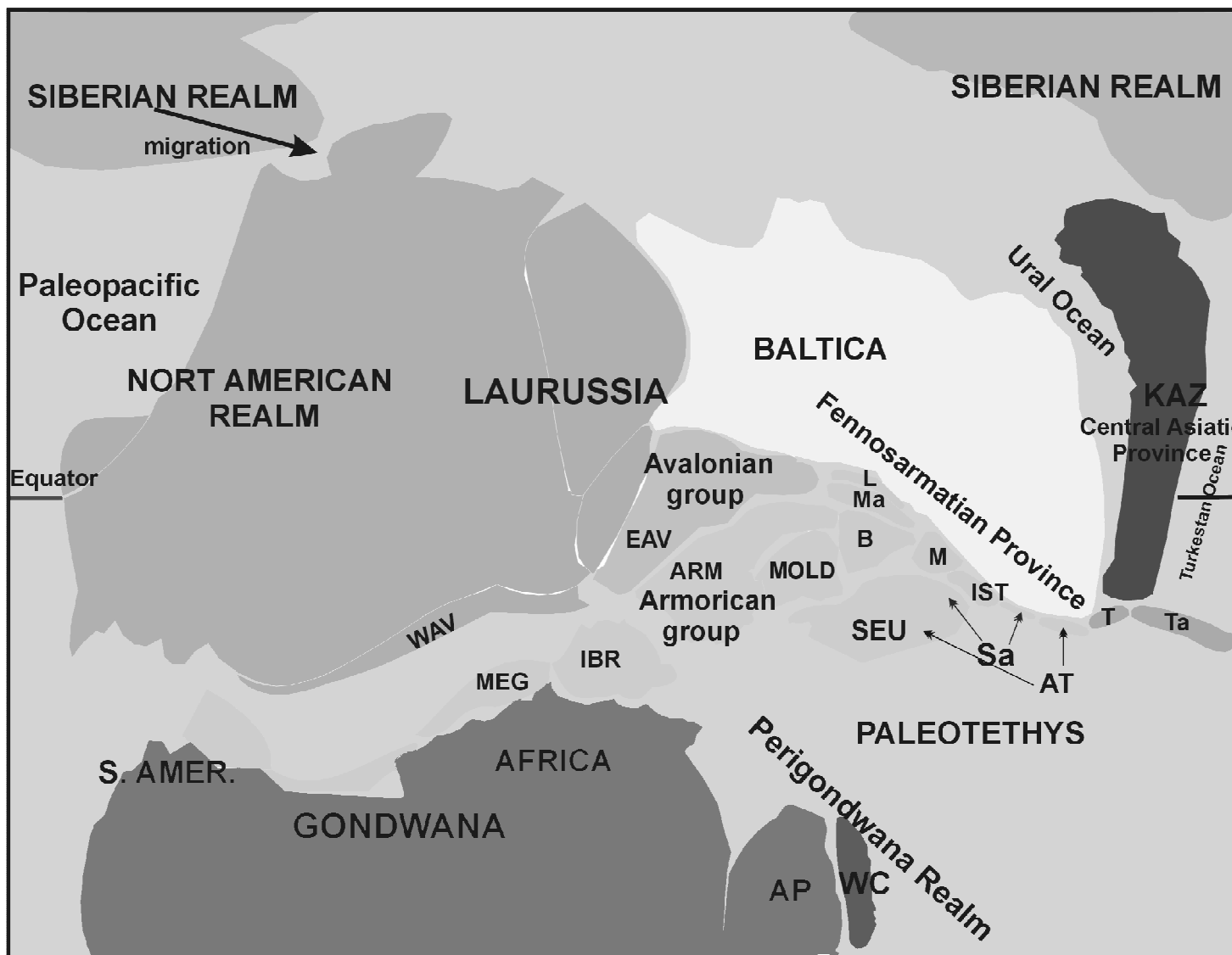








Paleogeografické schéma spodního karbonu udávající předpokládanou pozici jednotlivých teránů



**SEU – skupina
intralpských
teránů**

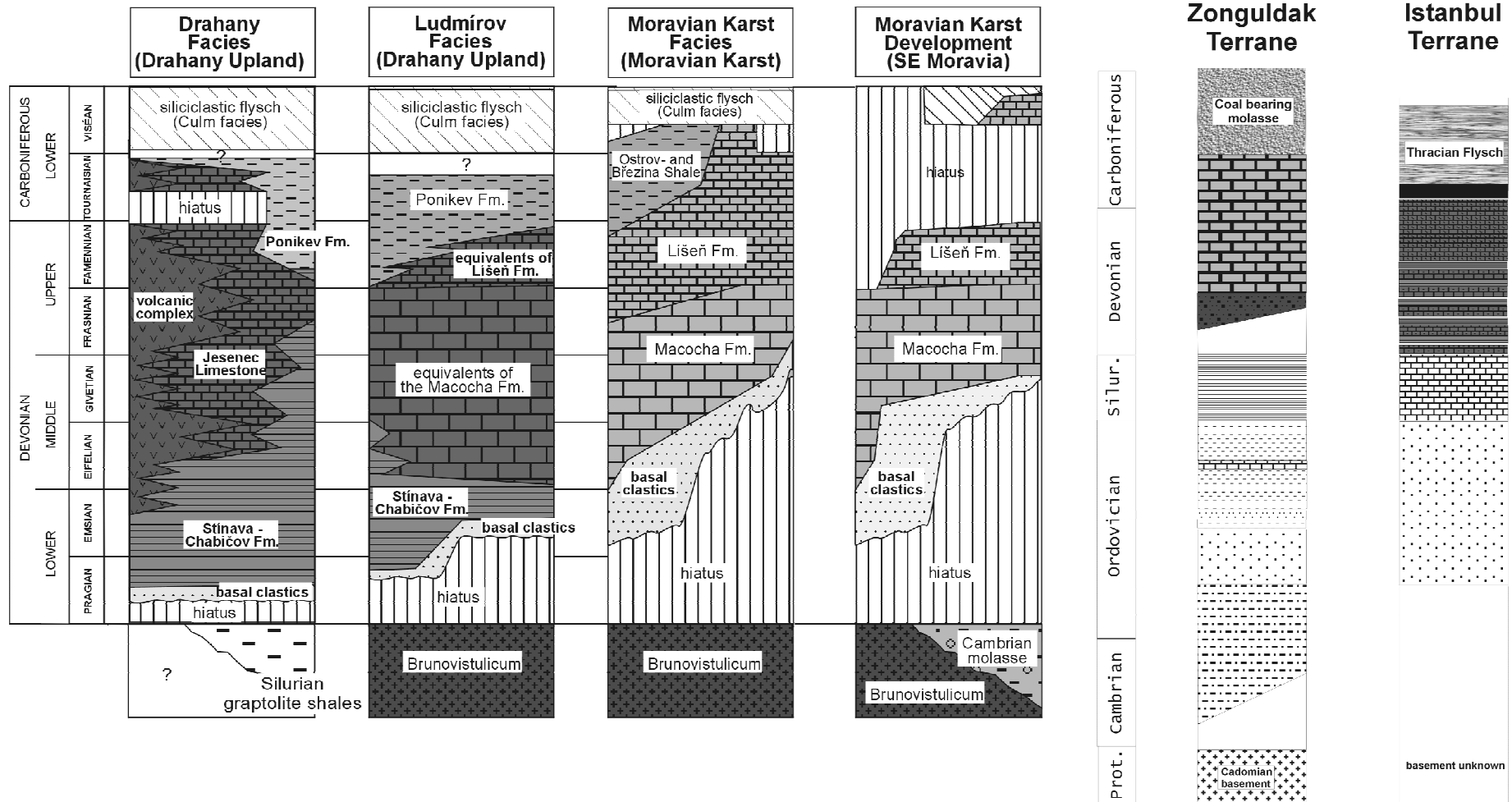
Sa - Sakarya

**T – Turanský
blok**

**IST – istanbulská
zóna**

**AT – anatolsko-
taurský blok**

Vedle dobré paleobiogeografické korelace je patrna i určitá shoda v litologickém vývoji mezi brunovistulickým teránem a istanbulskou zónou v devonu a spodním karbonu. Litologický vývoj istanbulského teránu s.str. s příkrovovou stavbou odpovídá ludmírovskému vývoji a zonguldakského teránu vývoji Moravského Krasu.



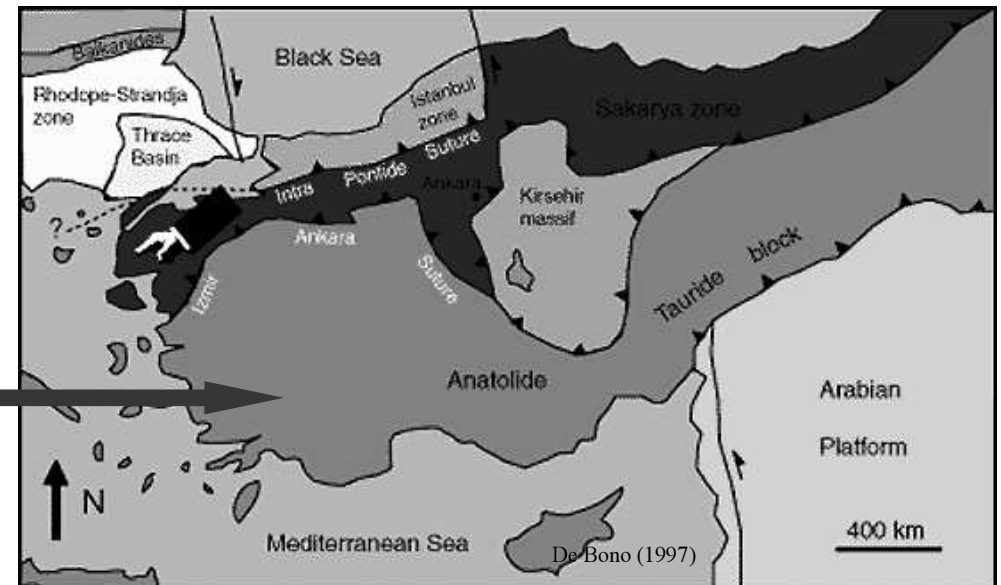
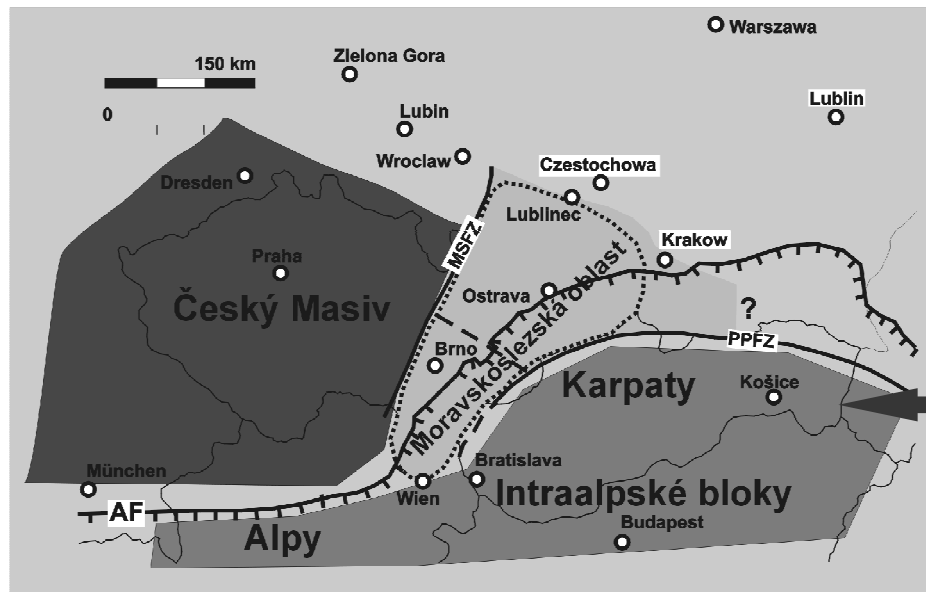
Srovnání s variskými jednotkami ve střední Evropě

SPODNÍ KARBON

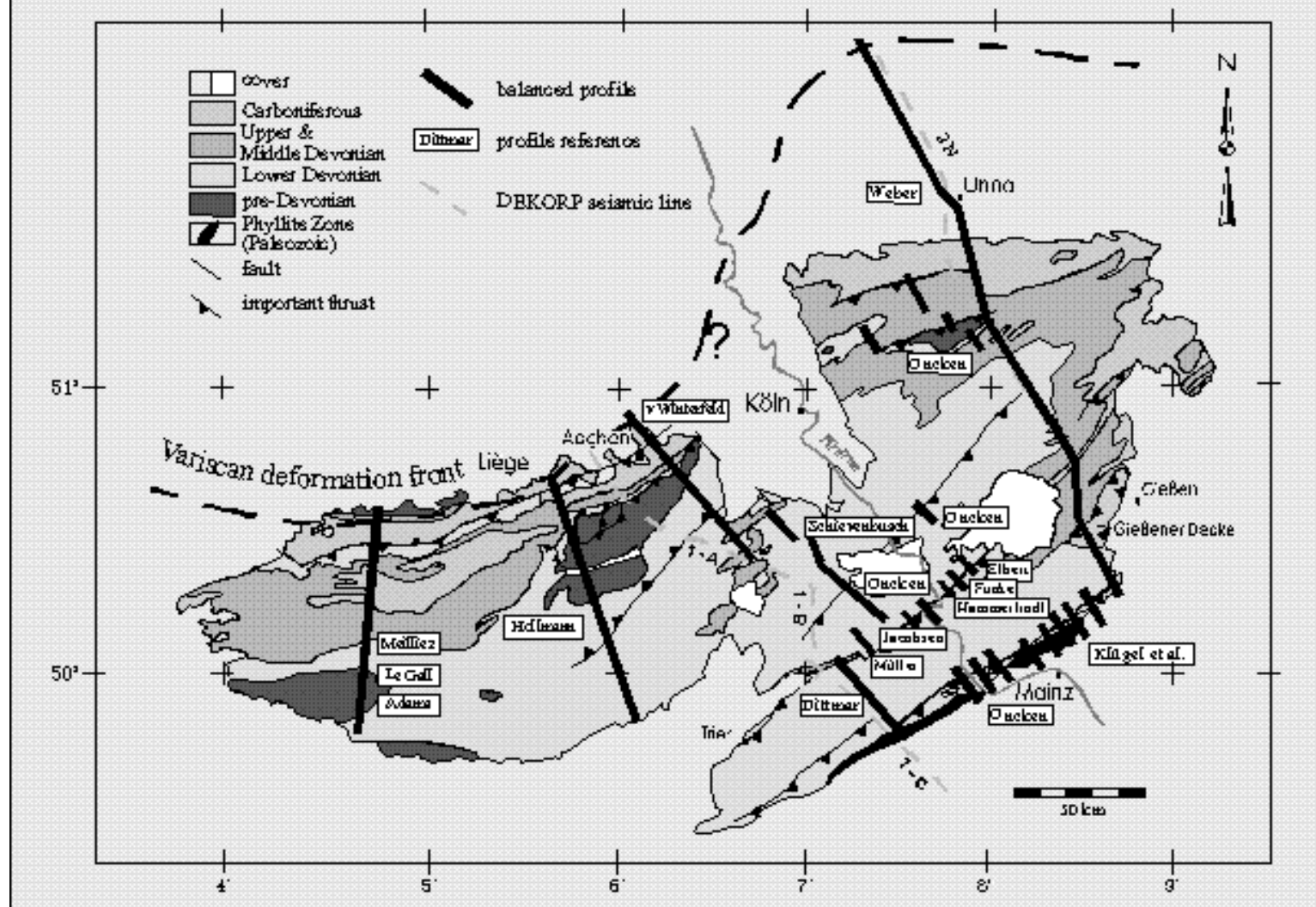
Zóna Istanbulu

Zóna Sakarya

Anatolsko-taurský blok



The Rhenohercynian (Belgium, W-Germany)



Jižní křídlo variscid – západní Evropa (jižní Francie)

Deformace a metamorfóza - polarita od severu k jihu

Vendéesko-limousinská zóna – jižní okraj dorzálního pásma. Různě metamorfované sedimentární a vulkanosedimentární komplexy (proter.-devon) eohercynská migmatizace a anatexe, vysokotlaké metamorfity,

Cevenská zóna – centrální krystalinikum (Iberie), slabě metamorfovaný až nemetamorfovaný sedimentární pokryv (proterozoikum-spodní paleozoikum), spodnokarbonský flyš

Moldanubický mikrokontinent

Iberský mikrokontinent

Gondwana

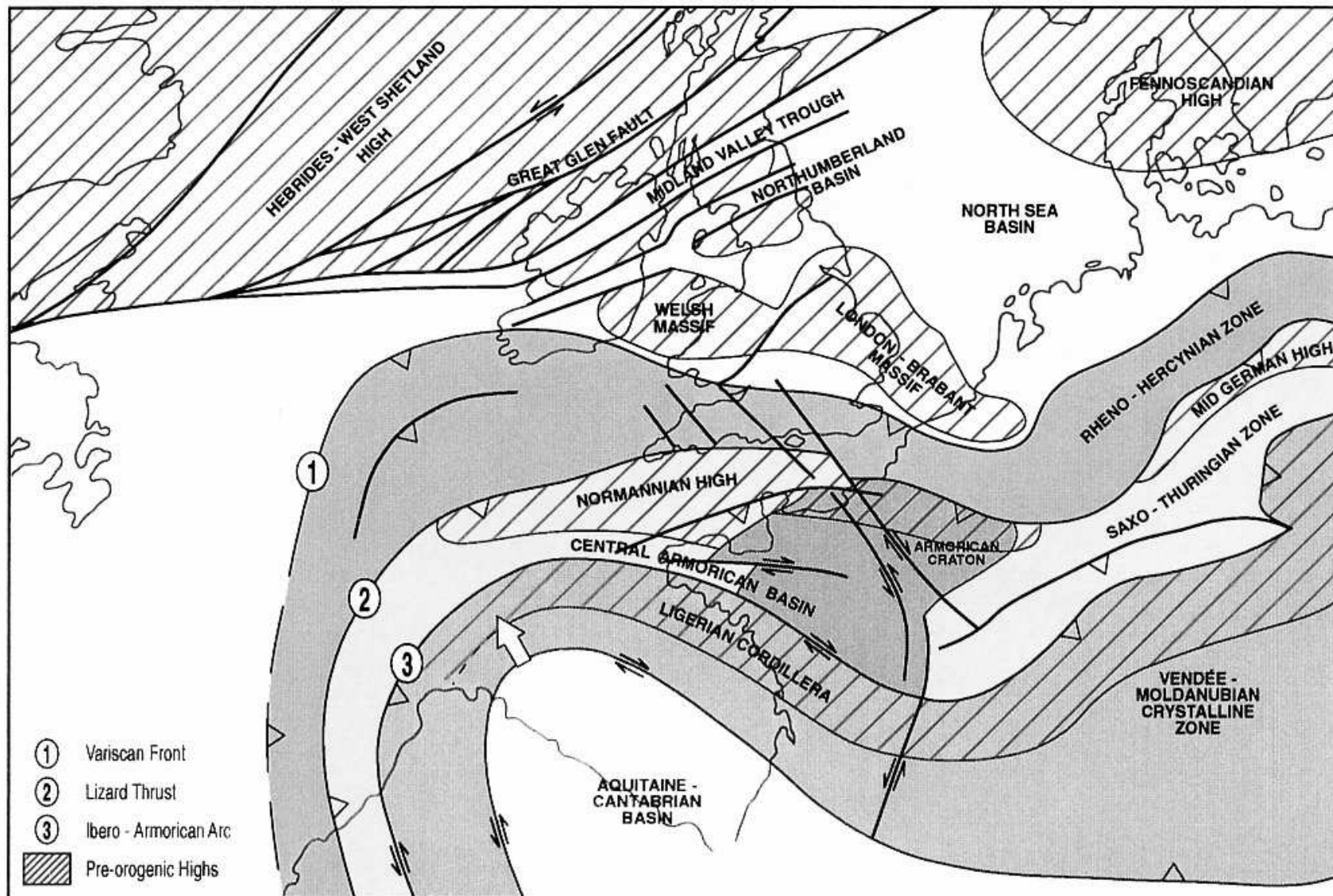


Figure 3.1 **VARISCAN TECTONIC ELEMENTS** (after Zeigler, 1988)

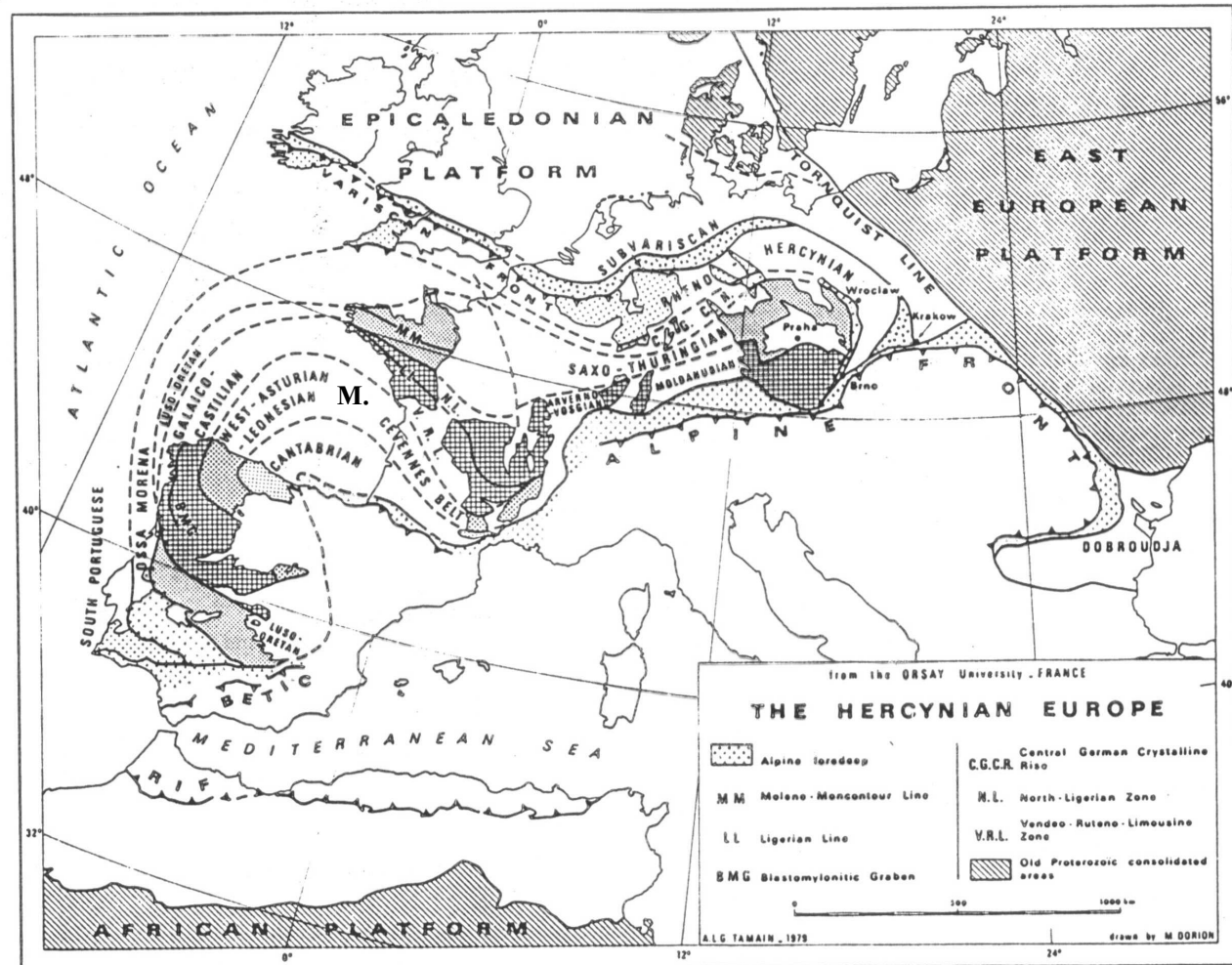


Figure 1. Map showing major zones of the Hercynian in Europe.

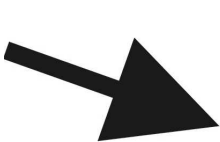
Jižní křídlo variscid – střední Evropa

Moldanubický terán

Brunovistulický terán

Perimediterranní terán – zahrnuje podloží helvetika a část peninika. Aktivní kont. okraj – magmatický oblouk.

Bosensko-norický terán – zahrnuje paleozoické jednotky vystupující v příkrovech austroalpinu a suedalpinu. Pasivní kontinentální okraj.



East European Craton

TESZ

Lysogory

Malopolska

East Avalonian

Brunovistulian

Armorican

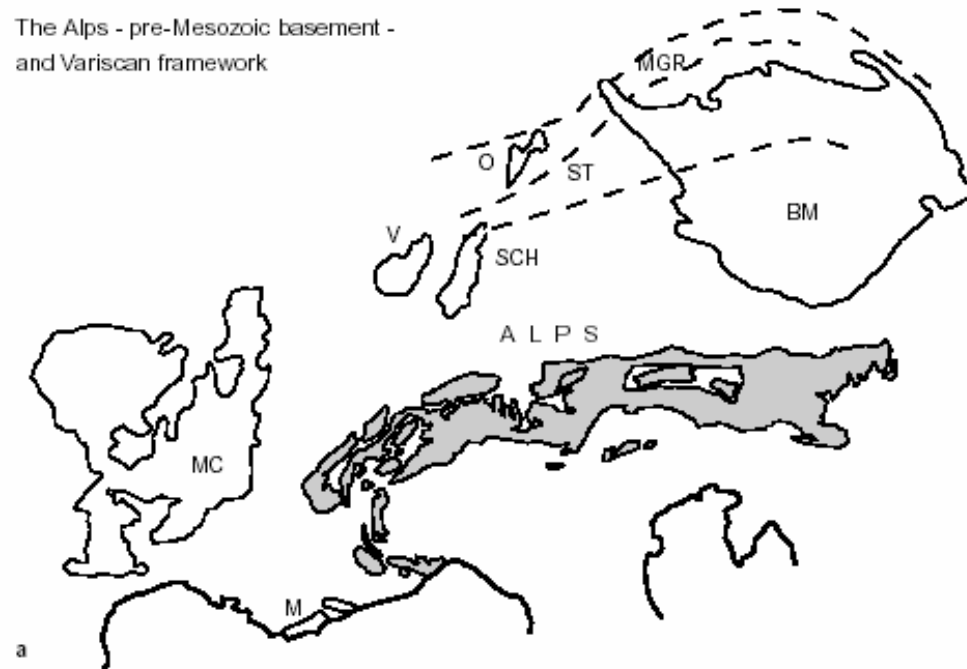
Perunica

Peri-mediterranean

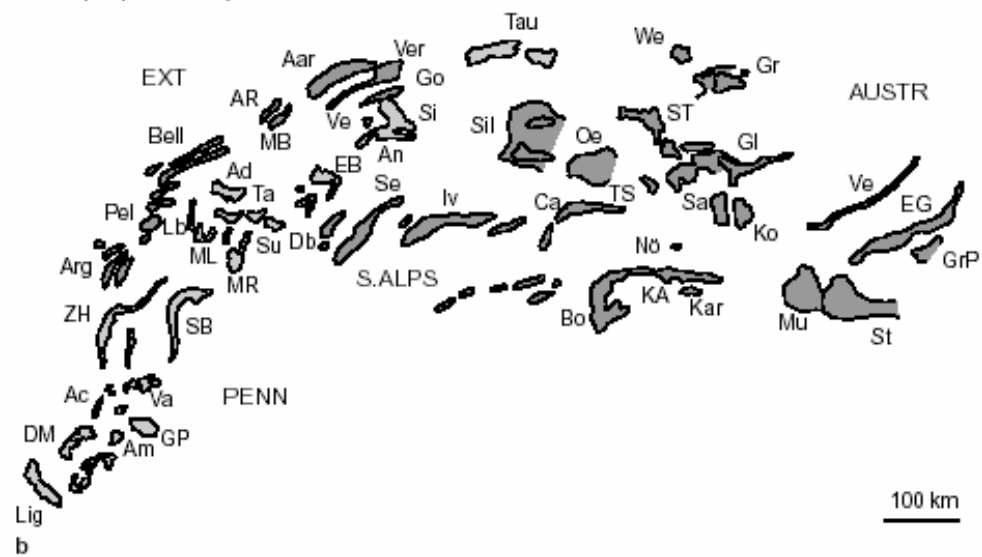
Noric-Bosnian



The Alps - pre-Mesozoic basement -
and Variscan framework



The Alps: preliminary Permian Reconstruction



Discussion

The data from both BM and ACD belts reveal that in both sectors of the Variscides similar processes occurred at the same time, but affected different continental units. Furthermore, the general direction of tectonic transport is basically N-directed in the BM and S- to SW-directed in Alpine basement units (Figs. 9, 10). These relationships suggest that BM and ACD represent different sectors of a double-vergent orogen, which formed between two different continental foreland blocks during the course of the Carboniferous. The Cetic massif, as well as Penninic units with Devonian to Early Carboniferous subduction-related plutonic suites, may have been located along southern, distal margins of the BM block and argue for the presence of a major subduction zone there separating BM and Alpine basement units.

The southeastern BM massif records Carboniferous final consumption of the oceanic lithosphere and the subsequent collision of the (Cadomian) Moravo-Silesian block (Brunovistulian microplate) with the Gföhl terrane. Mantle rocks were exhumed along the suture zone, together with subducted portions of the overlying rocks. In this sense, the entire Gföhl terrane (upper Moldanubian units), as it is exposed now, may represent part of the subduction zone which partially remelted due to entrainment of hot lithospheric mantle slabs into the subduction zone (BRUECKNER, 1998; BRUECKNER and MEDARIS, 1998; MEDARIS et al., 1998). The Moldanubian orogenic wedge was thermomechanically extremely weak, deformed within migmatite-grade metamorphic conditions and allowed rotation of the stiff foreland crust. The thermal imprint on Moravo-Silesian foreland units came from Moldanubian units (HOCK, 1995). All the major Group III granitoids may record the same melt event (FINGER

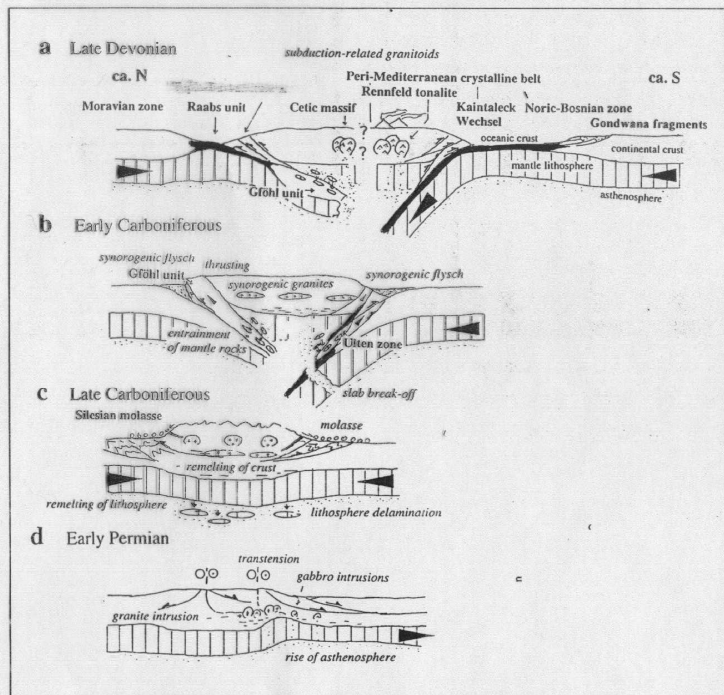
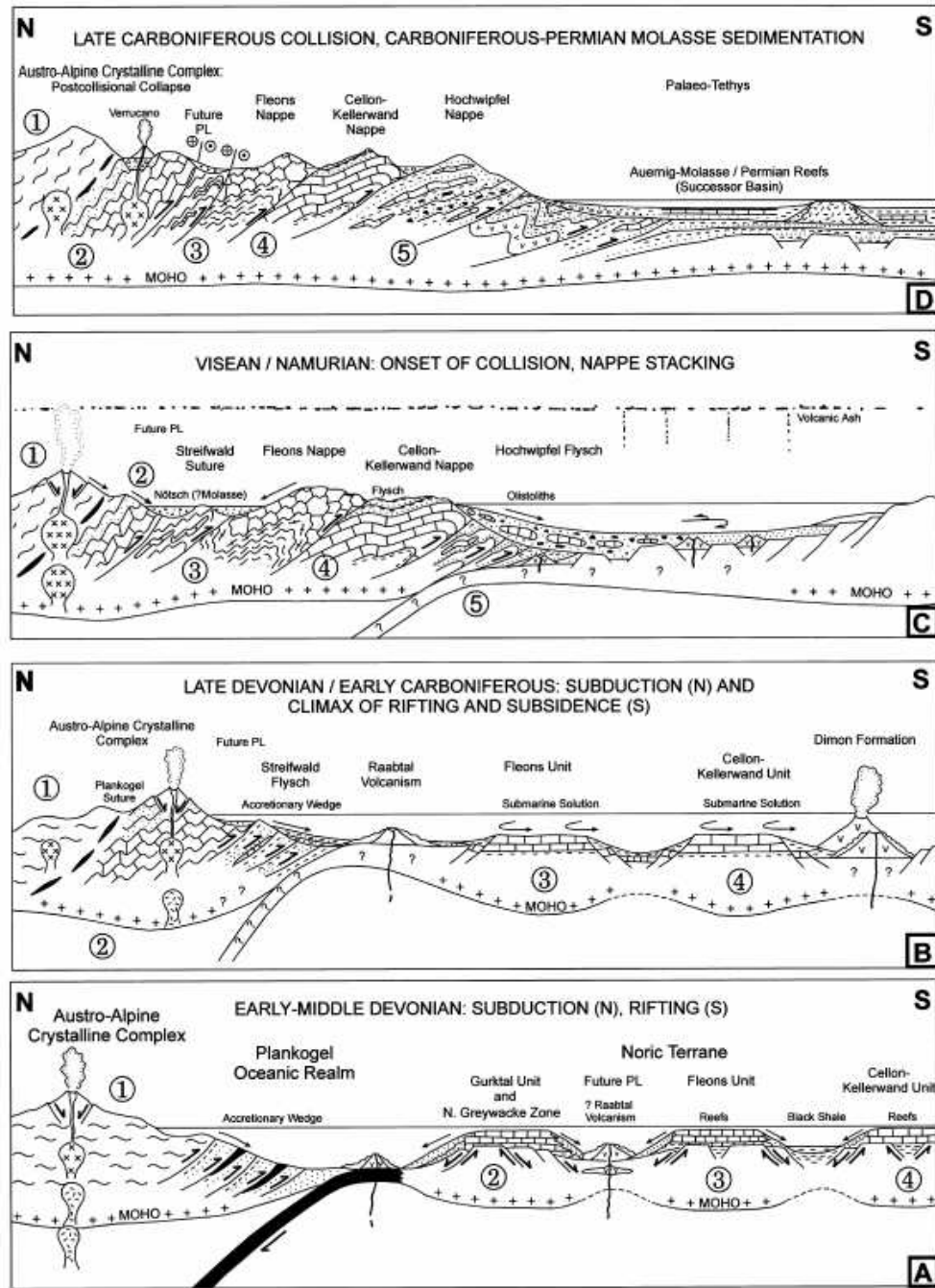


Fig. 9 Stages of tectonic evolution of Central Europe. a - Late Devonian; b - Visean; c - Late Carboniferous; d - Early Permian.



Brunovistulický terán

Raabský oceán

Perimediterranní terán

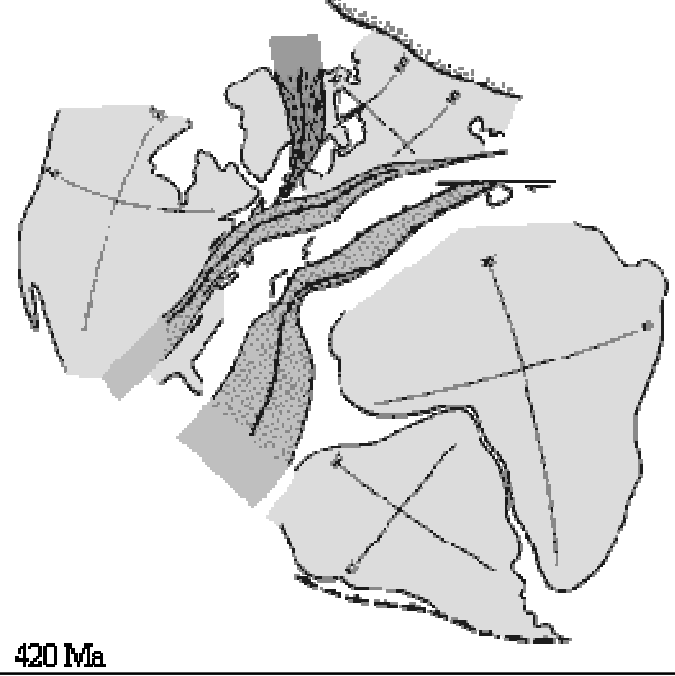
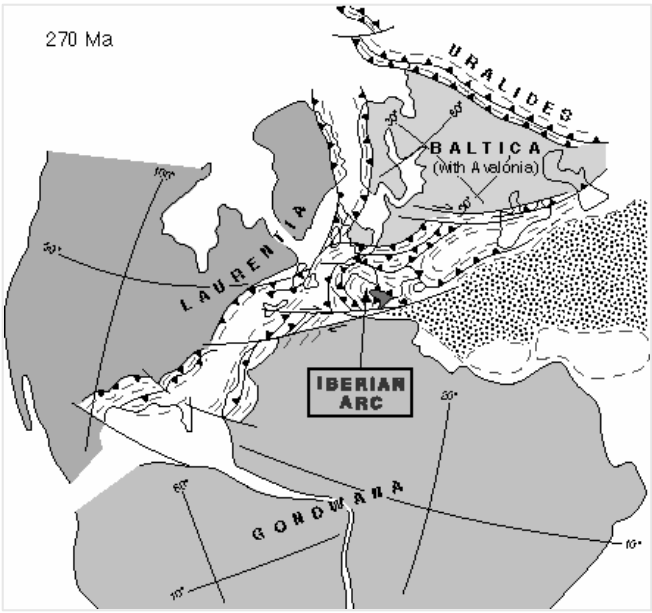
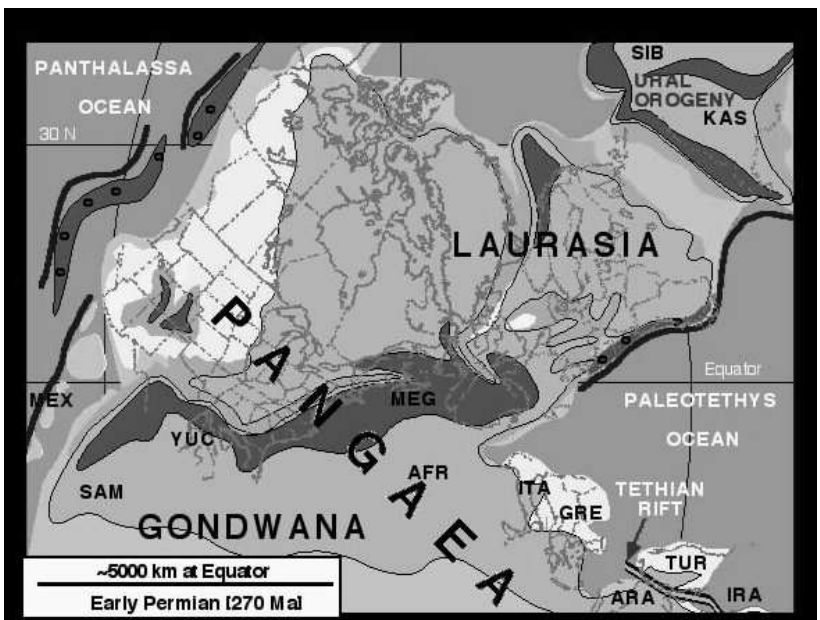
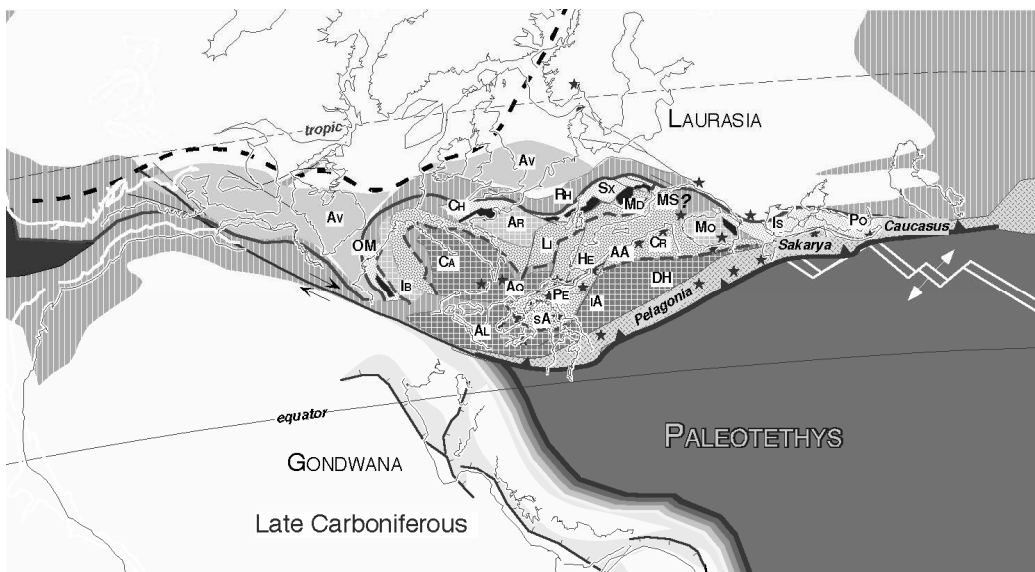
oceán

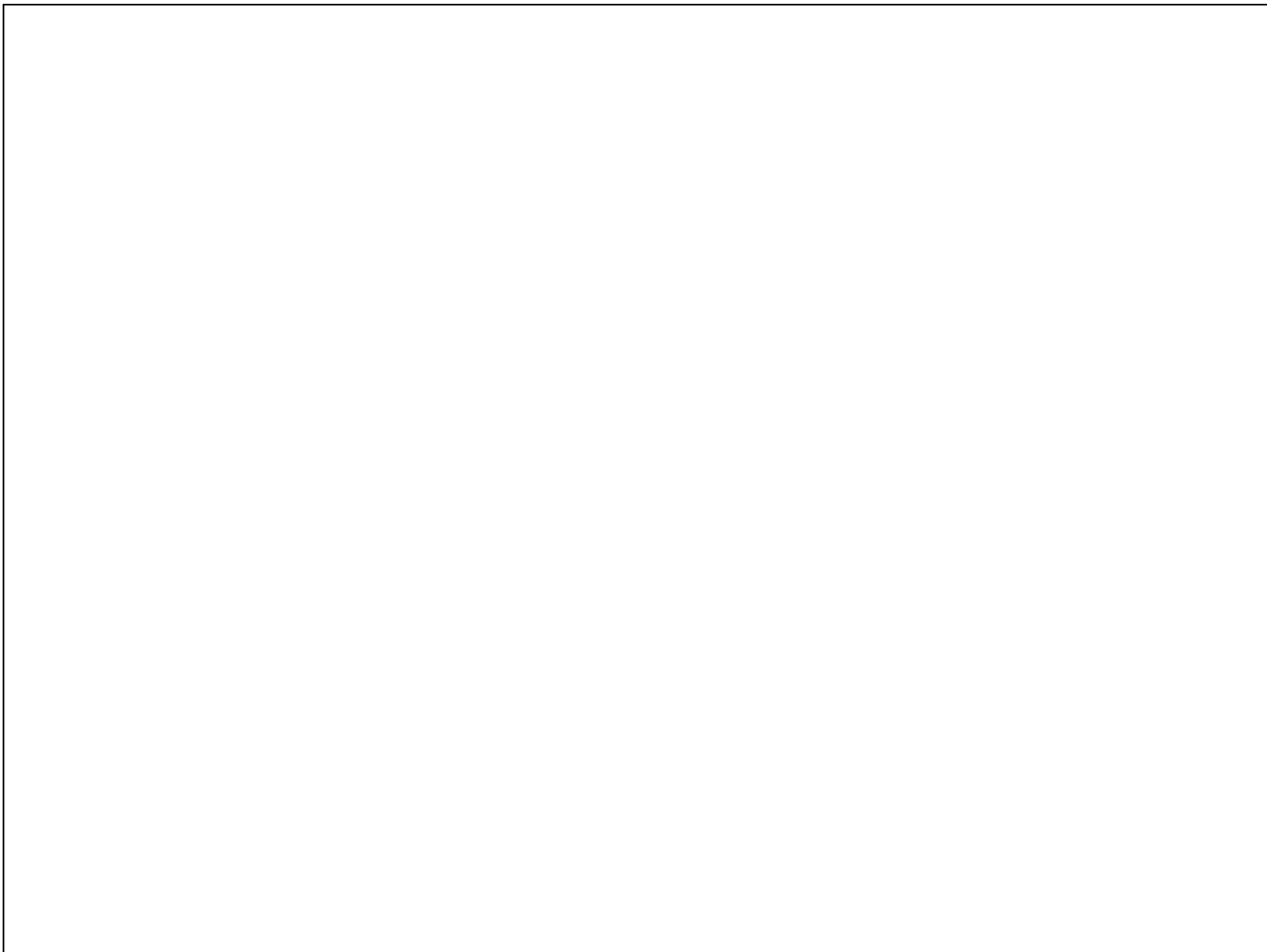
Bosensko-norický terán

Paleotethys

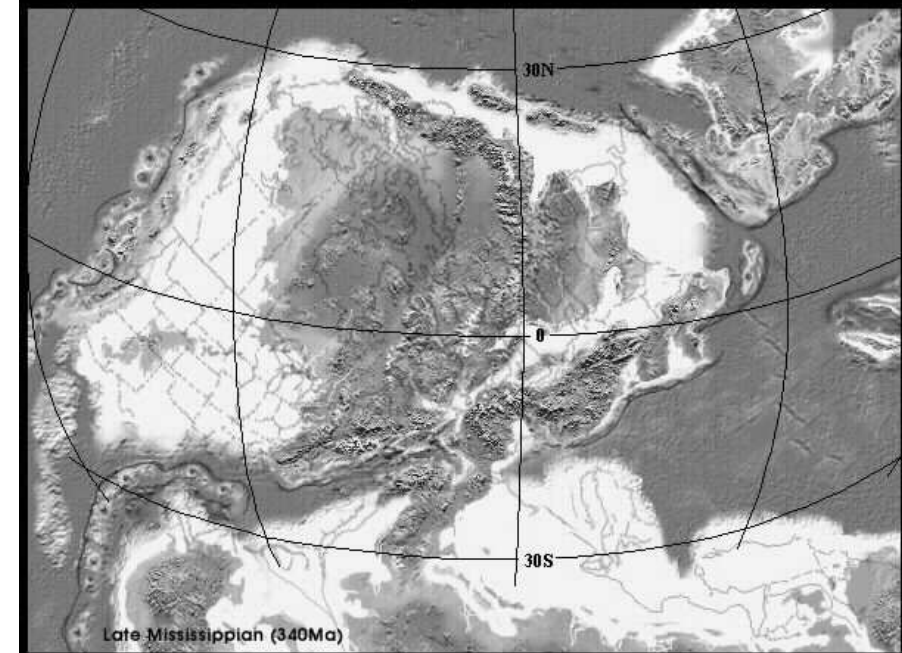
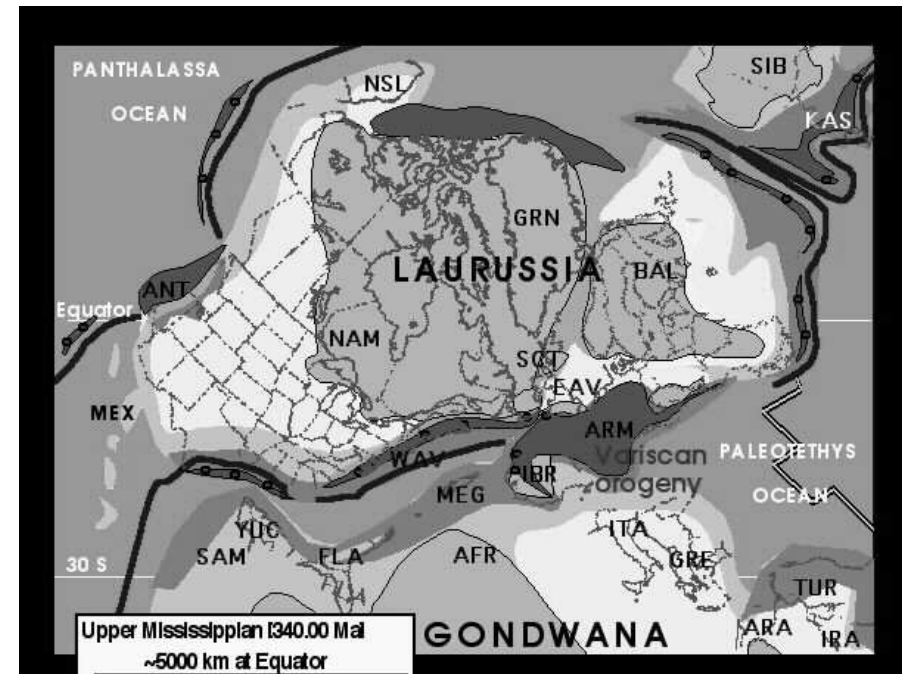
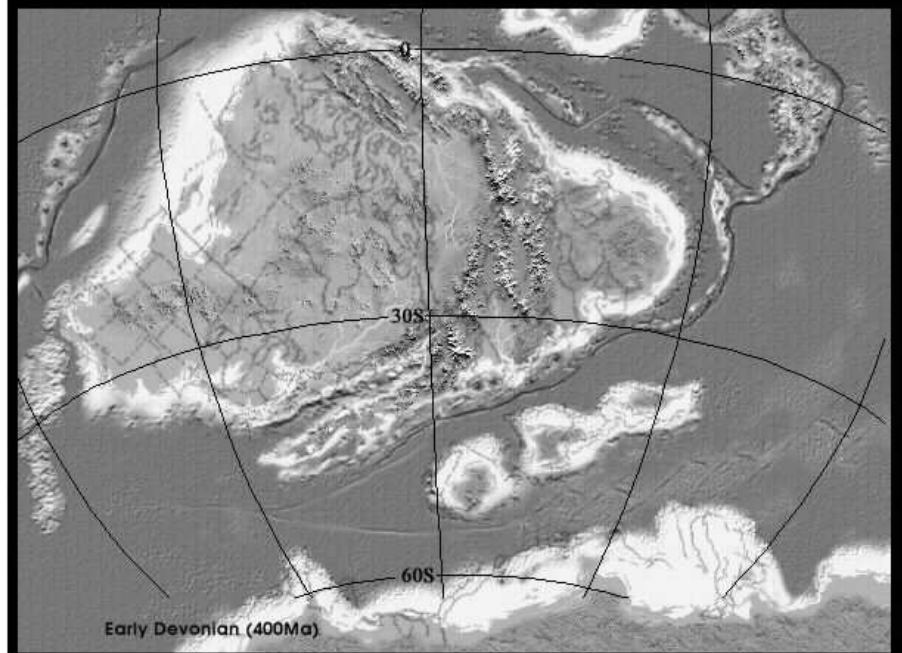
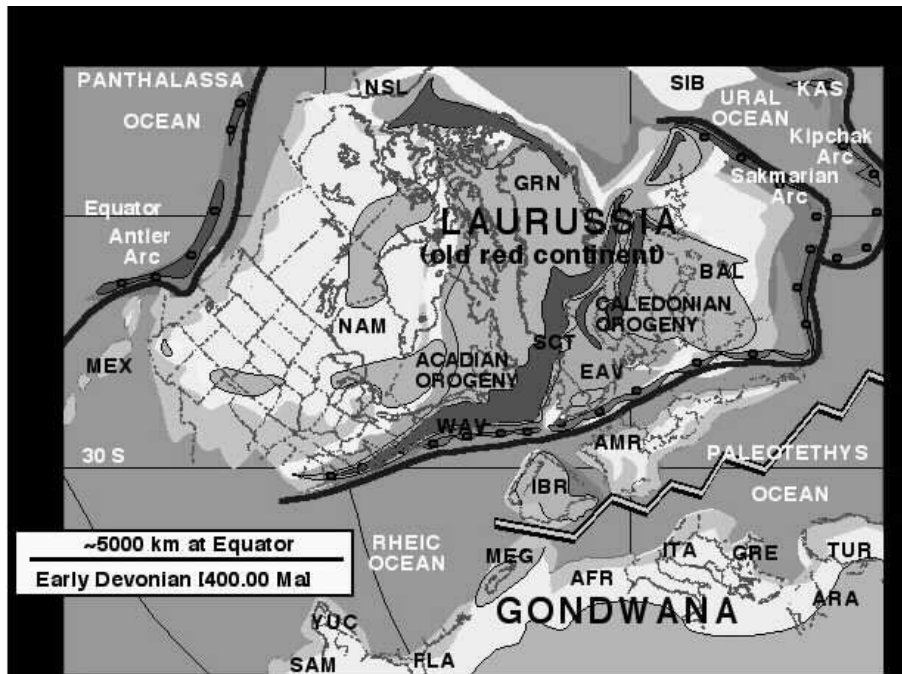
Gondwana

Geologický vývoj variských perigondwanských teránů ve svrchním karbonu a permu

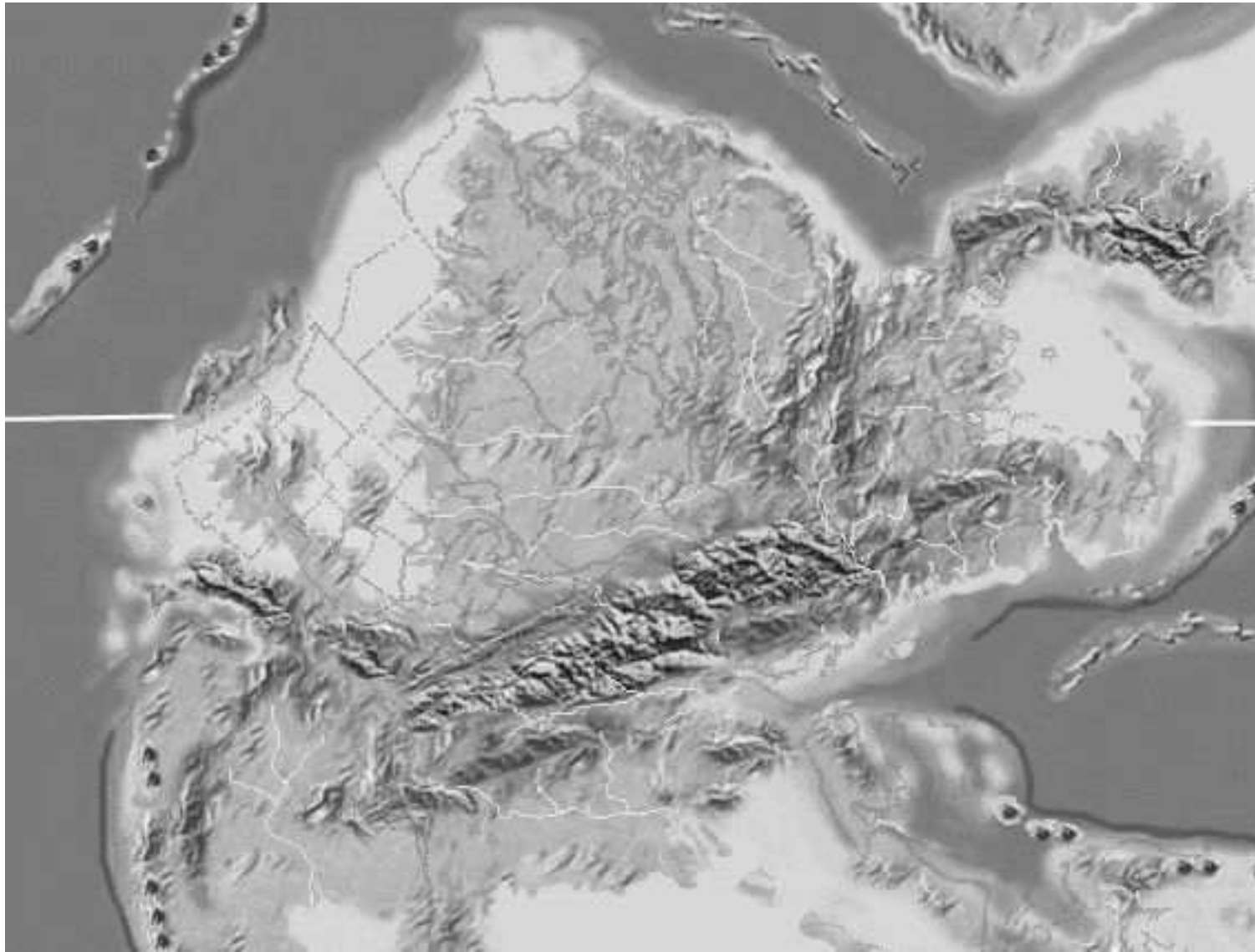


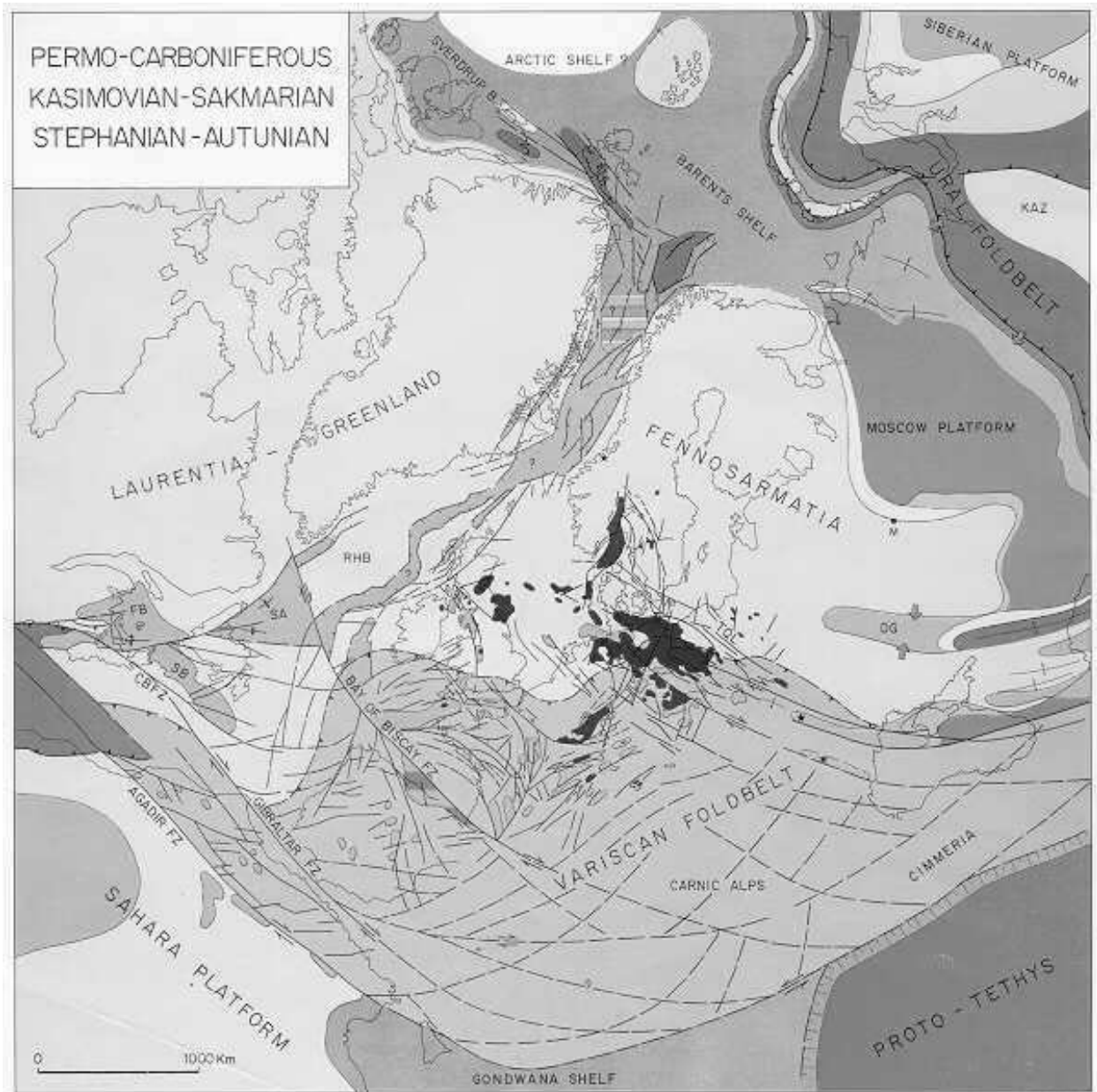


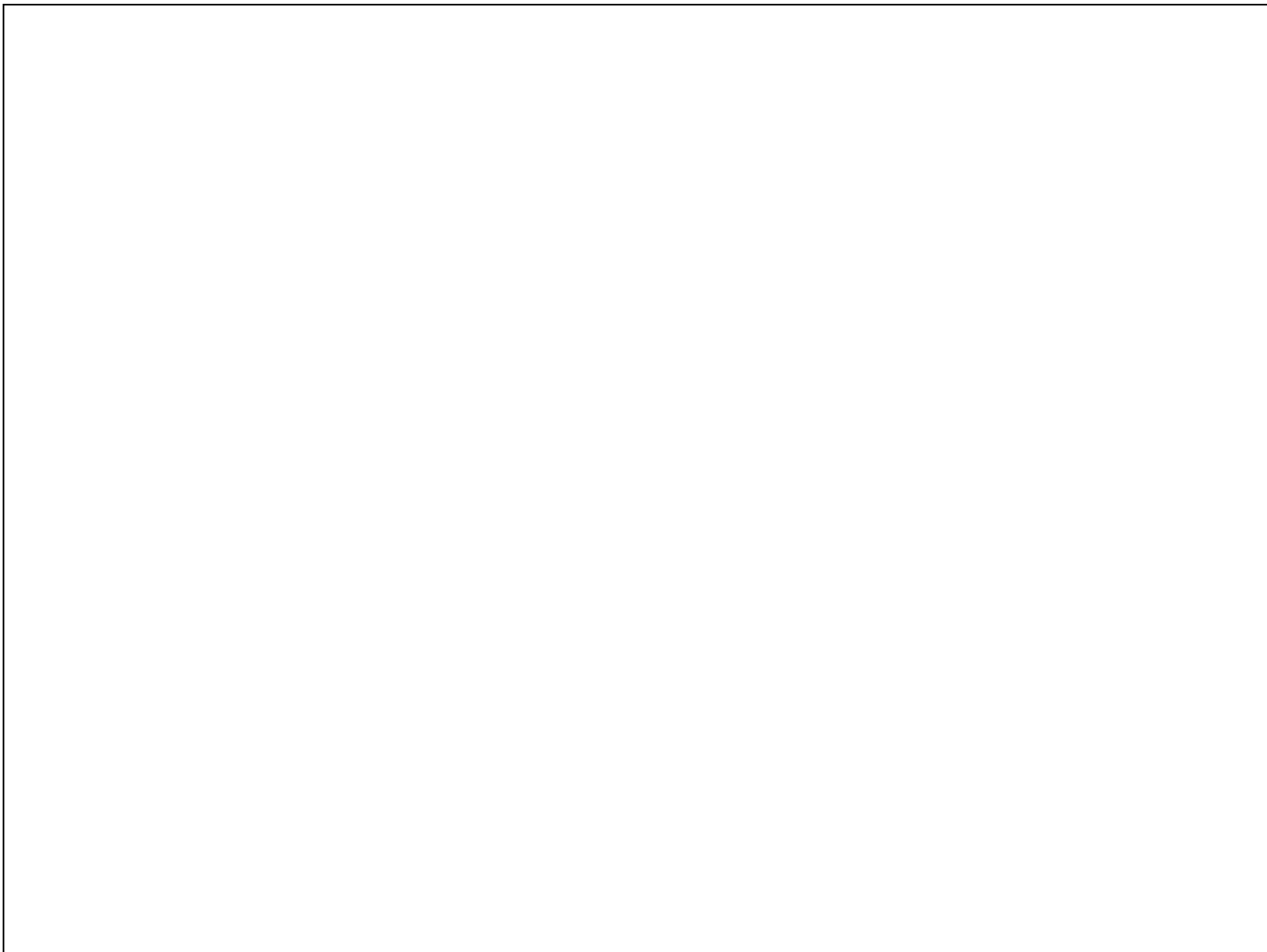
Vývoj variského orogenu v devonu a spodním karbonu











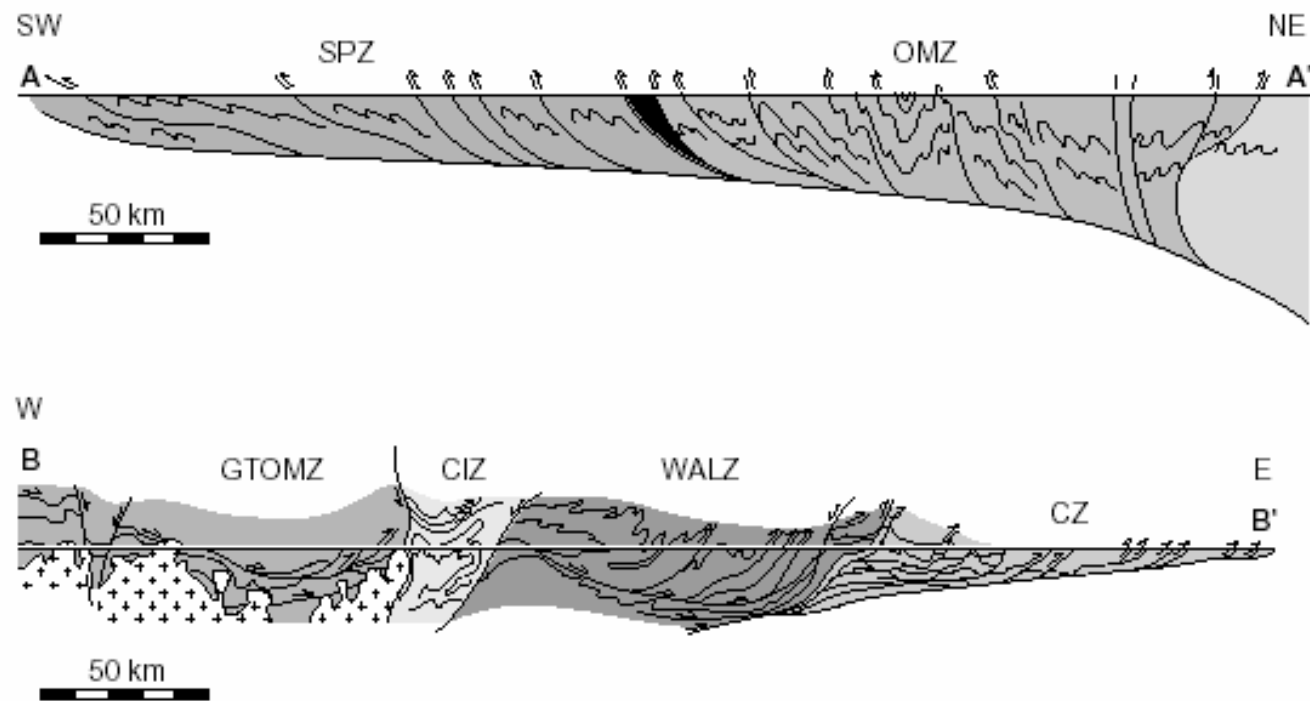


Figure 8.3: Simplified cross-sections of the Iberian Variscide Belt (ophiolites black). A-A': southwestern profile (redrawn from Ribeiro et al., 1995), B-B': northwestern profile (redrawn from Pérez-Estaún et al., 1991). Positions and abbreviations see Fig. 8.2.

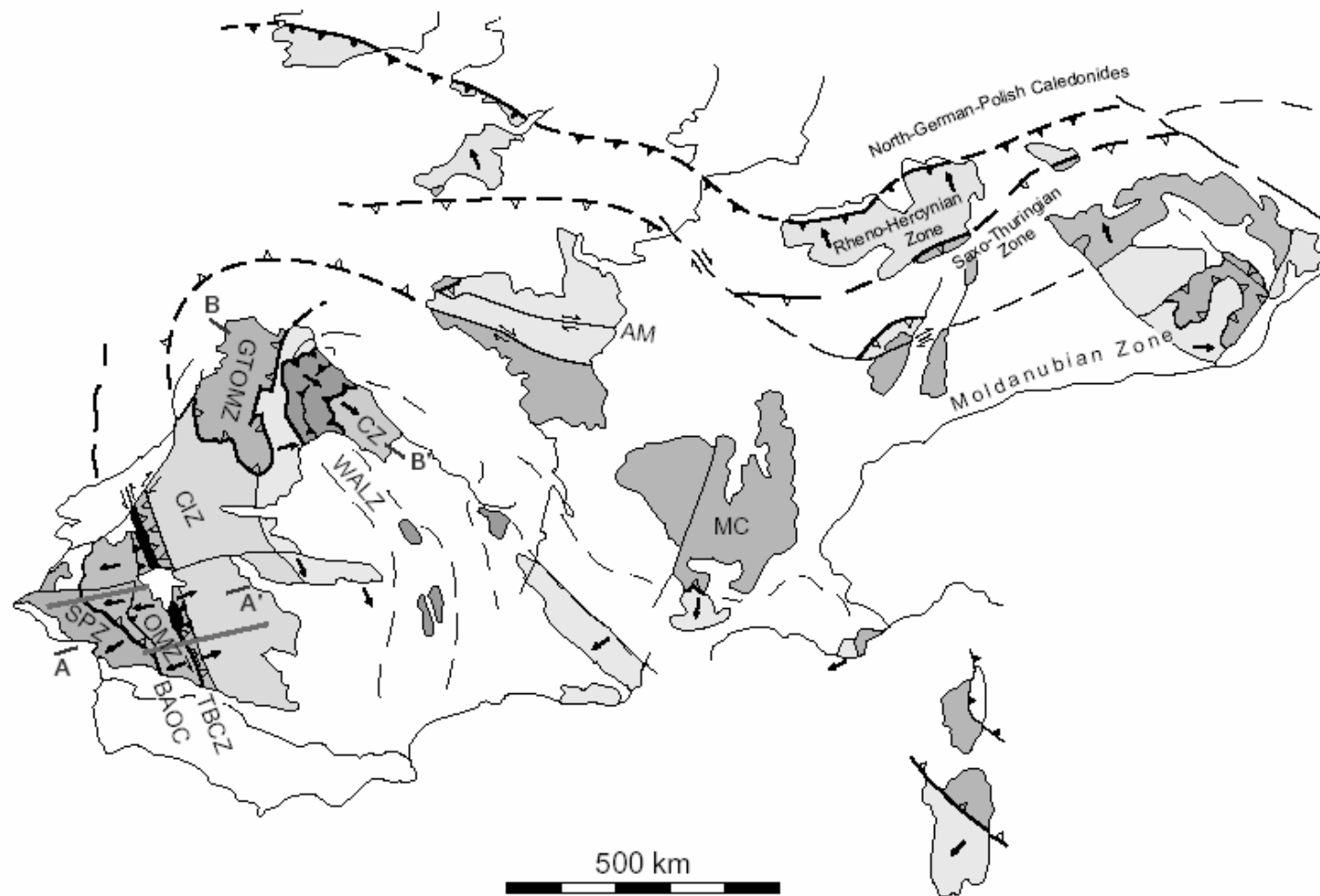


Figure 8.2: Main structural elements of the Variscides during the early Carboniferous (after Franke, 1989). Blue lines in southwestern Iberia mark the planned seismic profiles. Red marks indicate the positions of the cross-sections represented in figure 8.3. AM, Armorican Massif; BAOC, Southern Ophiolite Terrane; CIZ, Central Iberian Zone; CZ, Cantabrian Zone; GTOMZ, Galicia-Tras-Os-Montes Zone; MC, Massif Central; OMZ, Ossa Morena Zone; SPZ, South Portuguese Zone; TBCZ, Tomar-Badajoz-Cordoba Shear Zone; WALZ, West-Asturian Leonese Zone.