Forum Reply

doi:10.1130/G36030Y.1

Anatomy of a diffuse cryptic suture zone: An example from the Bohemian Massif, European Variscides

Karel Schulmann[1,2], Ondrej Lexa[3,1], Vojtěch Janoušek[1,3], Jean Marc Lardeaux[4], and Jean Bernard Edel[2]
[1]Czech Geological Survey, Centre for Lithospheric Research, Klárov 3, 118 21 Prague 1, Czech Republic
[2]EOST, Institute de Physique de Globe, UMR 7516, Université de Strasbourg, 1 rue Blessig, 67084 Strasbourg, France
[3]Institute of Petrology and Structural Geology, Faculty of Science, Charles University in Prague, Albertov 6, 128 43 Prague 2, Czech Republic
[4]Université Nice Sophia-Antipolis, UMR Géoazur, 250 Rue A. Einstein, 06560 Sophia Antipolis, France

Kroner and Romer (2014) argue that our model (Schulmann et al., 2014) is in conflict with the existence of the Rheic suture in the Bohemian Massif, and the 340 Ma age of ultrahigh-pressure (UHP) metamorphism. The model of the Rheic oceanic suture rimming the eastern margin of the Bohemian Massif suggests that the Brunia microcontinent is a part of Avalonia and formed a continuous Rhenohercynian Zone from southwest England to the Bohemian Massif.

The development of the Rhenohercynian Basin in southwest England started with passive-margin sequences of Upper Silurian age, followed by the formation of Lower Devonian basins, which were progressively inverted in the Upper Devonian as documented by syn-convergence clastic sedimentation in the Gramscatho Basin (Shail and Leveridge, 2009). However, in the Brunia, the Pragian basal conglomerates are followed by an arc/backarc volcano-sedimentary sequence dated at 371–374 Ma (Janoušek et al., 2014). In addition, during closure of the Rhenohercynian Ocean, and arrival of Emsian–Eifelian Lizard ophiolites, the carbonate platform was developed on Brunia suggesting that the stratigraphy and tectonic evolution of the two basinal areas were diametrically different.

The second major argument for the presence of the Rheic suture in the eastern margin of the Bohemian Massif is based on paleomagnetic results of Tait et al. (1997), who used magnetic directions from the Devonian succession on Brunia (interpreted as primary magnetizations) to document 90° clockwise rotation related to oroclinal bending. However, as shown by Edel et al. (2003), the "Devonian" directions are in fact of Early Carboniferous age because they were recorded also in Carboniferous granitoids in the heart of the Bohemian Massif (Central Bohemian Plutonic Complex) and thus represent Carboniferous remagnetization.

The last argument for Avalonian affinity of Brunia comes from zircon age populations of Proterozoic migmatites and granitoids (e.g., Mazur et al., 2010). According to these studies, comparable Paleoproterozoic inheritance in zircon populations is not present in the Moldanubian rocks, thereby confirming the exotic character of Brunia with respect to the rest of the Bohemian Massif. This assumption is denied by the recent study of Košler et al. (2014) documenting that the zircon populations from the Early Paleozoic metasedimentary sequences forming the bulk of the highly metamorphosed Moldanubian domain are identical to those from Brunia and the Barrandian domain.

The 340 Ma age of HP metamorphism dates a paroxysmal rheological collapse of the whole orogenic root. Rocks came to the surface not only from remote parts of the orogenic root due to laterally forced overturns, but also along the Saxothuringian suture where deeply subducted continental prism was extremely rapidly exhumed. This is not in conflict with early Saxothuringian oceanic subduction and emplacement of Devonian thrust sheets of Münchberg type prior to underthrusting of the Saxothuringian continent. However, dating of HP metamorphism using zircons and monazites is problematic, as shown by the thermodynamic modeling of zircon growth and its resorption by Skrzypek et al. (2012). These authors showed that most of inherited zircons in HP granulites were resorbed and blurred during the prograde path, while new zircons grew during exhumation and partial melting at 340 Ma.

Taken together, the data presented in our original paper sufficiently document the presence of a major oceanic suture between the Saxothuringian and Moldanubian zones. None of the arguments supporting the existence of the "Rheic" suture along the eastern margin of the Bohemian Massif have been proven so far. We argue that a single oceanic and continental subduction process can produce multiple HP and exhumation events on a time scale of several tens of millions of years, as exemplified by the Himalaya-Tibetan orogen (e.g. Guillot et al., 2003).

REFERENCES CITED

Edel, J.B., Schulmann, K., and Holub, F.V., 2003, Anticlockwise and clockwise rotations of the Eastern Variscides accommodated by dextral lithospheric wrenching: Palaeomagnetic and structural evidence: Journal of the Geological Society, v. 160, p. 209–218, doi:10.1144/0016-764902-035.

Guillot, S., Carzanti, E., Baratoux, D., Marquer, D., Mahéo, G., and de Sigoyer, J., 2003, Reconstructing the total shortening history of the NW Himalaya: Geochemistry Geophysics Geosystems, v. 4, doi:10.1029/2002GC000484.

Janoušek, V., Aichler, J., Hanžl, P., Gerdes, A., Erban, V., Pecina, V., Žáček, V., Pudilová, M., Hrdličková, K., Mixa, P., and Žáčková, E., 2014, Constraining genesis and geotectonic setting of metavolcanic complexes: A multidisciplinary study of the Devonian Vrbno Group (Hrubý Jeseník Mts., Czech Republic): International Journal of Earth Sciences, v. 103, p. 455–483, doi:10.1007/s00531-013-0975-4.

Košler, J., Konopásek, J., Sláma, J., and Vrána, S., 2014, U–Pb zircon provenance of Moldanubian metasediments in the Bohemian Massif: Journal of the Geological Society, v. 171, p. 83–95, doi:10.1144/jgs2013-059.

Kroner, U., and Romer, R.L., 2014, Anatomy of a diffuse cryptic suture zone: An example from the Bohemian Massif, European Variscides: Comment: Geology, v. 42, no. 7, p. e340, doi:10.1130/G35782C.1.

Mazur, S., Kröner, A., Szczepański, J., Turniak, K., Hanžl, P., Melichar, R., Rodionov, N.V., Paderin, I., and Sergeev, S.A., 2010, Single zircon U–Pb ages and geochemistry of granitoid gneisses from SW Poland: Evidence for an Avalonian affinity of the Brunian microcontinent: Geological Magazine, v. 147, p. 508–526, doi:10.1017/S001675680999080X.

Schulmann, K., Lexa, O., Janoušek, V., Lardeaux, J.M., and Edel, J.B., 2014, Anatomy of a diffuse cryptic suture zone: An example from the Bohemian Massif, European Variscides: Geology, v. 42, p. 275–278, doi:10.1130/G35290.1.

Shail, R.K., and Leveridge, B.E., 2009, The Rhenohercynian passive margin of SW England: Development, inversion and extensional reactivation: Comptes Rendus Geoscience, v. 341, p. 140–155, doi:10.1016/j.crte.2008.11.002.

Skrzypek, E., Štípská, P., and Cocherie, A., 2012, The origin of zircon and the significance of U–Pb ages in high-grade metamorphic rocks: A case study from the Variscan orogenic root (Vosges Mountains, NE France): Contributions to Mineralogy and Petrology, v. 164, p. 935–957, doi:10.1007/s00410-012-0781-1.

Tait, J.A., Bachtadse, V., Franke, W., and Soffel, H.C., 1997, Geodynamic evolution of the European Variscan fold belt: Palaeomagnetic and geological constraints: Geologische Rundschau, v. 86, p. 585–598, doi:10.1007/s005310050165.