Lithos 220–223 (2015) 116–132

Contents lists available at ScienceDirect

Lithos

journal homepage: www.elsevier.com/locate/lithos

The Moldanubian Thrust Zone — A terrane boundary in the Central European Variscides refined based on lithostratigraphy and U–Pb zircon geochronology

Mirosław Jastrzębski [a,*], Andrzej Żelaźniewicz [a], Mentor Murtezi [a], Alexander N. Larionov [b], Sergey Sergeev [b]

[a] Institute of Geological Sciences, Polish Academy of Sciences, Research Centre in Wrocław INGPAN, Podwale St. 50-449, Wrocław, Poland
[b] Centre of Isotopic Research, All-Russian Geological Research Institute, Sredny prospect 74, 199 106 St. Petersburg, Russia

ARTICLE INFO

Article history:
Received 16 October 2014
Accepted 28 January 2015
Available online 14 February 2015

Keywords:
Rheic suture
Variscan belt
Saxothuringian Terrane
Brunovistulian Terrane
Moldanubian Thrust
SIMS zircon geochronology

ABSTRACT

The zircon age populations of metavolcano-sedimentary successions in the Orlica–Śnieżnik Dome (OSD), Staré Město Belt (SMB) and Velké Vrbno Dome, the Sudetes (Poland and Czech Republic), have been used to refine the location of the Moldanubian Thrust Zone (MTZ), which is a boundary between the Saxothuringian Terrane of Gondwana descent and the Brunovistulian Terrane being a promontory of Laurussia. In the northern continuation of the MTZ, a set of multiply activated, regional-scale thrusts developed and brought into contact rocks of different ages and geological histories. Metarhyolites in the Orlica–Śnieżnik Dome and the Staré Město Belt have similar geochemistry and U–Pb isotopic zircon records, which is taken in favour of their coeval formation and common Saxothuringian affinity. Felsic metavolcanic rocks from the OSD and from the thrust-bounded upper and lower units of the SMB yielded protolith ages of 500 ± 3 Ma and 493 ± 4 Ma to 498 ± 5 Ma, respectively, which indicates that metavolcano-sedimentary successions in the OSD and SMB were deposited in Late Cambrian times. Structurally below these rocks, there are the highly sheared Brousek quartzites with detrital zircons that yielded a maximum depositional age of ~530 Ma. The mylonitic quartzites accommodate deformation induced by tectonic transport on the East Nýznerov Thrust, which is interpreted as the easternmost margin of Saxothuringia. This fault separates Palaeozoic rocks of the Saxothuringian Terrane from Neoproterozoic bimodal volcanogenic succession in the Velké Vrbno Dome of Brunovistulia, dated at ~558 Ma. The late-Variscan thermal events in the Early Carboniferous left imprints in the form of U-rich rims around the zircons of the metavolcanic rocks from the Staré Město Belt and only a very minor overprint in the zircons from the Velké Vrbno Dome and Orlica–Śnieżnik Dome.

1. Introduction

The Variscan orogenic belt developed through complex collisions between the Laurussia (Old Red Sandstone) continent and members of the Armorican Terrane Assemblage, which were derived from Gondwana (Franke, 1989; Nance et al., 2008; Tait et al., 1997; von Raumer et al., 2003). In the Cambrian and Early Ordovician, northern Gondwana was subjected to intra-continental rifting, which eventually brought about a bunch of continental fragments separated by marine basins that were floored by an oceanic crust (Cocks and Torsvik, 2006; Linnemann et al., 2008; Matte et al., 1990; Murphy et al., 2004; Pin and Marini, 1993; Tait et al., 1997). These fragments were effectively separated from Gondwana by spreading in the newly born Rheic Ocean (Linnemann et al., 2008) and became terranes, which eventually drifted northwards and finally accreted into Laurussia, completing the Variscan belt (Fig. 1a). However, igneous and sedimentary records of those events in individual Variscan terranes are incomplete and not fully understood. Moreover, the initial positions of these terranes at the Gondwana margin are also unclear. For instance, in the eastern part of Saxothuringia, fragments of archaeocyatha reefs were discovered in the Góry Kaczawskie fold belt (Białek et al., 2010), which places it in rather low latitudes in the Early Cambrian. Such a location does not fit the palaeoposition of Gondwana and the Armorican Terrane Assemblage in the Cambrian–Ordovician times presumed by Torsvik et al. (2012), although it seems feasible according to the reconstruction by McKerrow et al. (1992).

Among the other unclear issues is the evolution of the Saxothuringian and Brunovistulian margins and details regarding how they came into contact in the Sudetes (Figs. 1b, 2). Brunovistulia is a composite (super)-terrane that embraces at least two (Finger et al., 2000) or three different terranes of various origins and provenances (Żelaźniewicz et al., 2009). The western part of Brunovistulia was engaged in the Variscan orogen as the lower plate during a collision with the Moldanubia and Saxothuringia (Franke, 2006; Matte et al., 1990). The

* Corresponding author. Tel.: +48 71 3376343; fax: +48 71 3376342.
E-mail address: mjast@interia.pl (M. Jastrzębski).

http://dx.doi.org/10.1016/j.lithos.2015.01.023
0024-4937/

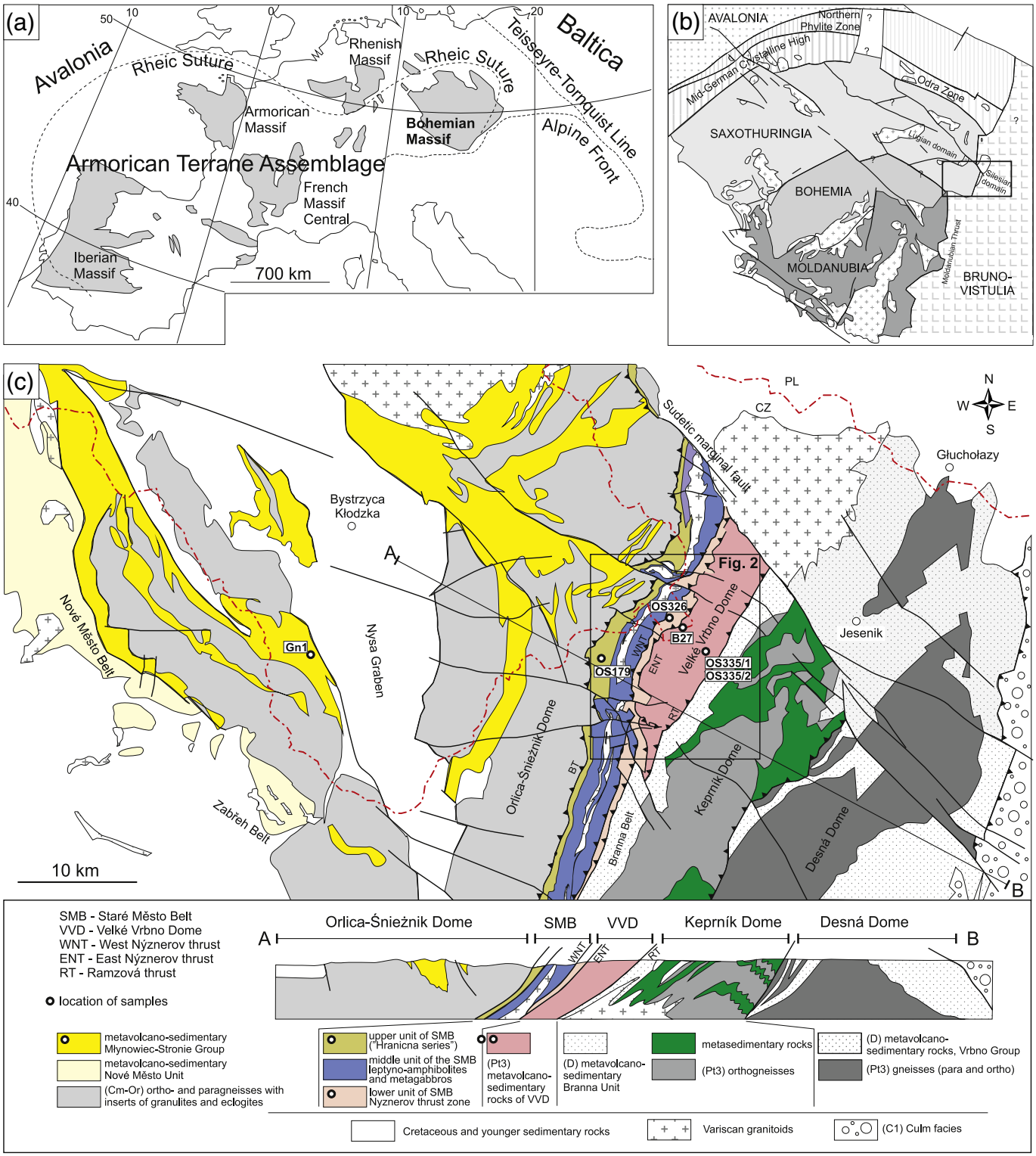

Fig. 1. (a) Variscan Massifs and main tectonic boundaries in central Europe (after Linnemann et al., 2008). (b) Terrane map of the Bohemian Massif (after Franke and Żelaźniewicz, 2000). (c) Geological sketch and schematic cross-section through the northern Moravosilesian Thrust Zone (compiled from Don, 1982; Sawicki, 1995; Schulmann and Gayer, 2000).

thrust boundary was originally recognised by Suess (1912) in Moravia and referred to as the Moldanubian Thrust. It continues farther to the north, where in the Sudetes and the Fore–Sudetic Block, a bundle of individual thrusts forms the Moldanubian Thrust Zone (Fig. 2) (e.g., Don et al., 2003; Franke and Żelaźniewicz, 2002; Oberc-Dziedzic and Madej, 2002). There is ongoing debate regarding which of these thrusts are actually the true boundary between the terranes involved and where the western limit of Brunovistulia is located (Bederke, 1929; Jastrzębski, 2012; Kröner et al., 2000; Oberc, 1968a; Opletal and Pecina, 2000, 2004; Schulmann and Gayer, 2000; Skácel, 1979; Štípská et al., 2006). The problem is complicated because the terrane boundary was localised within lithologically similar metasedimentary–volcanogenic successions that occur in the footwall and hanging wall (e.g., Košler et al., 2014; Opletal and Pecina, 2004). Despite the