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Tectonophysics 444 (2007) 93 – 110
TECTONOPHYSICS
www.elsevier.com/locate/tecto

Evolution of paleostress fields and brittle deformation of the Tornquist Zone in Scania (Sweden) during Permo-Mesozoic and Cenozoic times

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Received 22 March 2007; received in revised form 6 August 2007; accepted 8 August 2007
Available online 16 August 2007

Abstract

The NW-SE oriented Sorgenfrei–Tornquist Zone (STZ) has been thoroughly studied during the last 25 years, especially by means of well data and seismic profiles. We present the results of a first brittle tectonic analysis based on about 850 dykes, veins and minor fault-slip data measured in the field in Scania, including paleostress reconstruction. We discuss the relationships between normal and strike-slip faulting in Scania since the Permian extension to the Late Cretaceous–Tertiary structural inversions. Our paleostress determinations reveal six successive or coeval main stress states in the evolution of Scania since the Permian. Two stress states correspond to normal faulting with NE-SW and NW-SE extensions, one stress state is mainly of reverse type with NE-SW compression, and three stress states are strike-slip in type with NNW-SSE, WNW-ESE and NNE-SSW directions of compression.

The NE-SW extension partly corresponds to the Late Carboniferous–Permian important extensional period, dated by dykes and fault mineralisations. However extension existed along a similar direction during the Mesozoic. It has been locally observed until within the Danian. A perpendicular NW-SE extension reveals the occurrence of stress permutations. The NNW-SSE strike-slip episode is also expected to belong to the Late Carboniferous–Permian episode and is interpreted in terms of right-lateral wrench faulting along STZ-oriented faults. The inversion process has been characterised by reverse and strike-slip faulting related to the NE-SW compressional stress state.

This study highlights the importance of extensional tectonics in northwest Europe since the end of the Palaeozoic until the end of the Cretaceous. The importance and role of wrench faulting in the tectonic evolution of the Sorgenfrei–Tornquist Zone are discussed.

Keywords: Tornquist Zone; Scania; Paleostress field; Brittle deformation; Basin formation; Inversion

1. Introduction

The NW-SE oriented Tornquist Zone s.l. (Fig. 1) is the longest structural lineament in North Central Europe. It was initially described in its Polish segment

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0040-1951/$ - see front matter © 2007 Elsevier B.V. All rights reserved.
doi:10.1016/j.tecto.2007.08.005

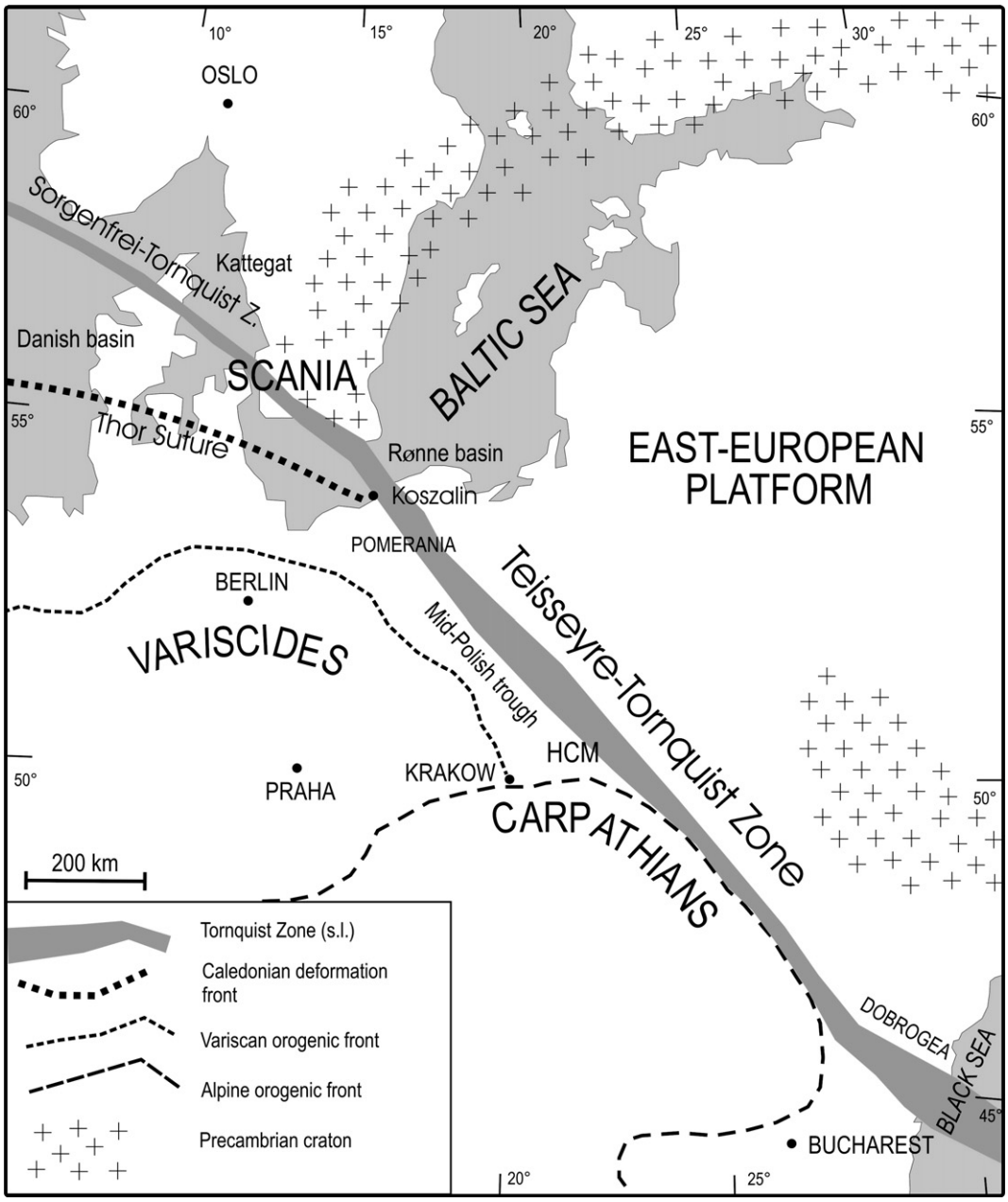

Fig. 1. Sketch map of the Tornquist Zone and major orogenic fronts in Northern and Central Europe (modified after Pozaryski et al., 1982; Berthelsen, 1998).

by Teisseyre (1893) then recognised by Tornquist (1908, 1910) as a lineament extending from the Black Sea to the Baltic Sea: the Teisseyre–Tornquist Zone (TTZ). The Sorgenfrei–Tornquist Zone (STZ; Sorgenfrei and Buch, 1964; Berthelsen, 1992) constitutes its north-western prolongation into Sweden and Denmark. The STZ and the Thor Suture (Fig. 1) respectively represent the northern and southern branches of the Tornquist Fan (Berthelsen, 1992, 1998). The Tornquist Zone s.l. (TZ) experienced a long and complex history, as revealed by numerous geological and geophysical data (e.g., Guterch et al., 1986; Dadlez, 1987; EUGENO-S Working Group, 1988; Babel Working group, 1991, 1993; Guterch et al., 1994; Mogensen and Jensen, 1994; Mogensen, 1994, 1995; Erlström et al., 1997; Pharaoh, 1999; Kutek, 2001; Thybo, 2001; Plomerová et al., 2002; Lamarche et al., 2003; Babuška and Plomerová, 2004).