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1 Was continent-continent collision in the Alpine domain responsible for the Late Cretaceous structural inversion in the Tornquist Zone?

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The Tornquist Zone is a *c.* 25-50 km wide fault zone developed between the NW European Craton and the Baltic Shield/East European Platform. The NW-SE trending Tornquist Zone is divided into a nortwestern segment, the Sorgenfrei-Tornquist Zone, and the Teisseyre-Tornquist Zone to the southeast. The two segments are offset in a right-stepping én echelon fashion, and the segments are joined-up in the overlap zone by the Rønne Graben trending NE-SW. Structural inversion of the Tornquist Zone has generally been accepted to be associated with Alpine foreland deformation. Right-lateral transpressional movements along the Tornquist Zone have thus been ascribed to continent/continent collision between Europe and Africa. However, NW translation of the NW European Craton relative to the East European Platform should result in extension and subsidence of the Rønne Graben, whereas the Rønne Graben show conspicuous Late Cretaceous inversion structures. Alpine continent/continent collision is therefore not considered to have been responsible for the Late Cretaceous basin inversion in the Tornquist Zone.

An alternative tectonic model of basin inversion in the Tornquist Zone is based on structural analysis of the inversion structures in the Rønne Graben. In the southern Rønne Graben, the Upper Cretaceous can be divided into a lower pre-inversion interval and upper syn-inversion series. Restoration of the pre-inversion interval illustrates that the early Late Cretaceous deposits extended across the Rønne Graben with only

small thickness changes along minor extensional faults. During the late Late Cretaceous, the Rønne Graben underwent structural inversion. The pre-inversion interval was uplifted and folded along with erosion to the east in the Rønne Graben and in the eastern footwall block (the East European Platform). At the same time the western footwall block (the NW European Craton) subsided, and the pre-inversion interval is here superseded by the late Late Cretaceous series. In the western Rønne Graben, thinning of the late Late Cretaceous series above the inversion folds illustrates that the structural inversion was contemporaneous with deposition of the (syn-inversion) late Late Cretaceous interval.

The interrelationship between the pre- and syn-inversion intervals illustrates that compression and structural inversion were related to westward tilting of the Rønne Graben between the subsiding NW European Craton to the west and the rising East European Platform to the east. The tilting and structural inversion of the graben section took place during vertical simple shear; the vertical offset amounted to $c.$ 1 km. The Late Cretaceous evolution further north in the central part of the Sorgenfrei-Tornquist Zone likewise illustrates, that structural inversion was governed by vertical movements between the NW European Craton and the Baltic Shield.