The Banda Arcs and Carpathia/Pannonia: new insights on the Tethys Twins

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The Outer Banda and Carpathian arcs, of eastern Indonesia and Europe respectively, are examples of the highly arcuate fold-and thrust belts enclosing extensional basins that have been named oroclines. Both regions have experienced large scale extension within what is, overall, a compressive regime created by the convergence of major continental blocks and, despite major differences stemming from the quasi-oceanic setting of the one and intracontinental the setting of the other, there are reasons to suppose that comparative studies may produce insights into the evolution of both areas (Milsom, 2000). Processes in the Banda region are in some respects more open to direct examination, because extension is more recent, deep seismic activity is more widespread and basement structures are not concealed beneath thick sediment cover. To a considerable extent these advantages have compensated for the disadvantages of poor access and a relatively sparse database. The final two decades of the Twentieth Century saw rapid advances in understanding the area in terms of both geology and geophysics.

In the first decade of the 20th century the techniques of seismic tomography began to be applied (Hall & Spakman, 2003) and confirmed the earlier interpretation, based on hypocentre locations, of the presence of a single, scoop-shaped, slab underlying the Banda Sea (Milsom, 2001). Intensive field and laboratory studies of Seram, the largest island in the northern part of the Outer Arc, then identified exposures of rocks metamorphosed at ultra-high temperature in the vicinity of the crust-mantle boundary, which led to the abandonment of the earlier interpretations of the associated ultramafic rocks as ophiolitic (Pownall *et al*., 2013). The extreme extension that brought these rocks to the surface also affected the subducted lithosphere that underlies the Banda Sea, and is one of the many pointers to the importance of asthenospheric flows in creating the present situation.

While similar in many respects, the Carpathia-Pannonia area shows an orocline at a much later stage in its evolution, with some evidence concealed by later overprinting and some processes that would have been important in earlier stages now no longer occurring. On the other hand, some other aspects of orocline formation are likely to be better displayed there than in the Banda region.

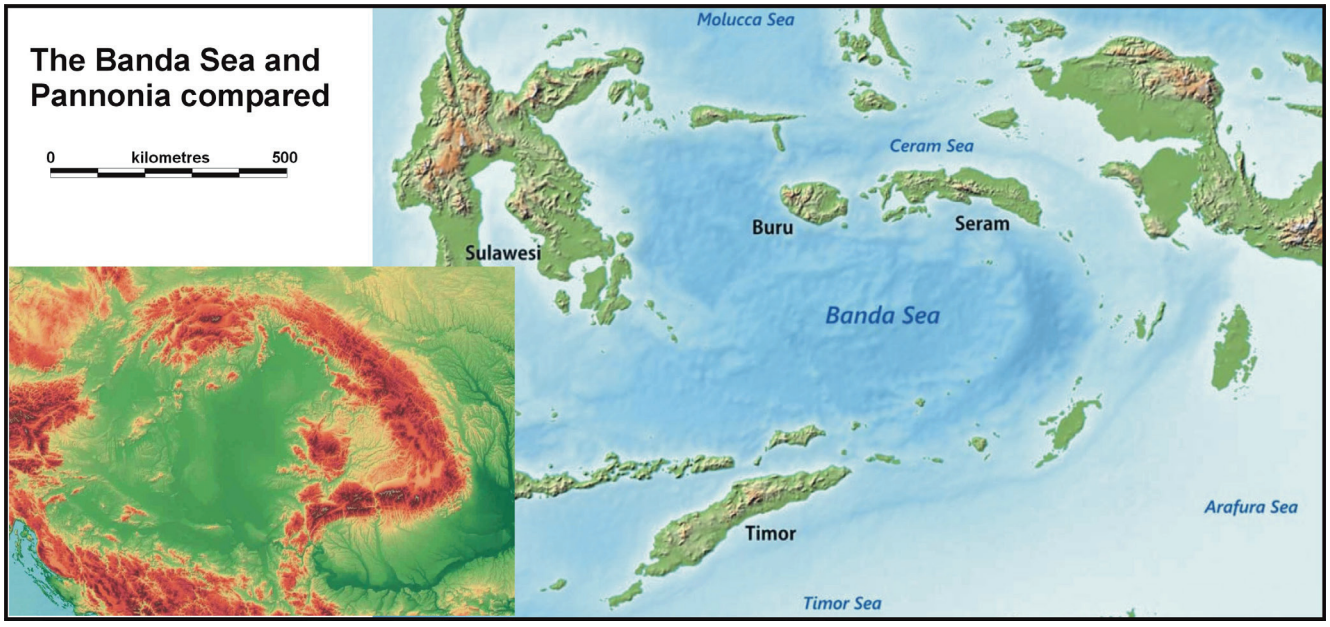

Fig. 1. The Banda Sea region and the Carpathian/Pannonian Basin regions, to common scale (Banda Sea: Freeworld maps https://www.freeworldmaps.net/ocean/bandasea; Carpathia/Pannonia: Global Mapper image based on SRTM topographic grids)

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The now increasingly well determined history of the destruction of the Western Tethys and the development of the Alps-Carpathian-Dinarides orogen (e.g. Handy *et al*., 2015) offers strong support for theories involving mantle flow as a key factor in orocline formation.

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