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PLATE TECTONICS AND PALEOGEOGRAPHY:

Geodynamic evolution of the Black Sea Basin:

Constraints from structural data and fault kinematic analyses along the Black Sea coasts (Pontides and Crimean Mountains)

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The geodynamic evolution of the Black Sea Basin can be unravelled by structural and kinematic analyses along its inverted margins. In the frame of the Darius Programme we acquired structural data in the Pontides and in the Crimean Mountains. In the Western Pontides intense extensional faulting occurred during the Early Cretaceous and controlled the deposition of the siliciclastic sediments dated as Hauterivian to Albian (Hippolyte et al., 2010). Development of horst and graben structures resulted in the gravitational sliding of limestone olistoliths. The early Cretaceous fault blocks are unconformably overlain by a Late Cretaceous sequence that generally begins with Coniacian red pelagic limestones.

Similar to the Western Pontides, in the Central Pontides intense extensional deformation took place during the Early Cretaceous when sedimentation was characterized by olistoliths and debris flows. Tectonic subsidence locally reached 3600 m. During the Cenozoic, inversion of normal faults created a doubly vergent orogenic wedge (Espurt et al., 2014).

On the conjugate margin of the Black Sea, we mapped an array of collinear normal faults in the western part of the Crimean Mountains (Hippolyte et al., 2018). These faults trend parallel to the crustal-scale structures of the Black Sea Basin. Similar to the Pontides, extensional block faulting occurred during the deposition of debris flow and olistoliths, and the extension direction was NE-SW. The syn-rift sequence is dated as Valanginian-Late Albian. The post-rift sequence, that unconformably overlies the graben structures, starts in the Cenomanian. It is devoid of any normal faults or olistoliths. In the eastern Pontides we studied the onshore extension of the transfer faults of the eastern Black Sea Basin. From the Early Campanian to the Late Paleocene they only move with normal slip, possibly related to thermal subsidence in the Black Sea Basin (Hippolyte et al., 2017). Therefore, their strike-slip displacement, related to the opening of the Eastern Black Sea Basin, must predate the Campanian.

Given the fact that extensional structures are presents on the two conjugate margins of the Black Sea, and that the directions of extension are normal to the crustal structures (mid-Black Sea High and Black Sea margins), we infer that the Early Cretaceous extension is related to the rifting phase of the Black Sea Basin. We conclude that rifting occurred from the Valanginian to the Late Albian. The age of the breakup unconformity in Crimea, and the Late Cretaceous evolution of the transfer faults, suggest a drifting period from the Cenomanian to the Santonian, a period of intense volcanic activity and weak extensional deformation along the southern margin of the Black Sea. Based on the directions of rifting we propose that the Black Sea Basin opened with rotations accommodated by transform faults at its western and eastern margins, as a consequence of two asymmetric rollbacks of the northward subducted Neo-Tethyan slab. The inversion of the Black Sea margins results from several shortening events related to the continental collisions that occurred to the south. We characterize these events by distinct compressional stress fields from the Eocene to the Quaternary.

Keywords: rifting, collisions, stress field, Pontides, Crimea