
Tertiary evolution of the Rhenish Triple Junction: stratigraphic correlation of Alpine foreland deformation and mountain building

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Abstract

The Rhenish Triple Junction consists of the NNE-SSW striking Upper Rhine Graben, the similarly oriented Hessen Depression and the NW-SE striking graben trend that includes the Neuwied Basin and Lower Rhine Embayment. Situated at the perimeter of the North Alpine Foreland, close temporal and causal relationships existed between the Tertiary (Middle Eocene—Pliocene) sedimentary sequences of this structure and the contemporaneous, either extensional or compressional tectonic phases related to the Alpine orogeny. Following overall S-N directed rift propagation during the Middle and Late Eocene, the triple junction was structurally fully defined from the Eocene-Oligocene transition onwards. Its stratigraphic evolution was governed in particular by episodic changes in foreland stress regime and by eustatic changes in sea level.

From its origin around the Ypresian-Lutetian transition, the tectono-sedimentary setting and, consequently, the paleogeographical development of the graben system has been repeatedly modified. At different times, saline passages connected indirectly the Upper Rhine Graben with the world ocean system.

Most likely, a stratigraphic correlation occurred between the accumulation of sedimentary sequences within the Rhenish Triple Junction, tectonomagmatic episodes of uplift and volcanism affecting the Rhenish Massif and discrete orogenic phases associated with the formation of the Alpine mountain chain. However, a correlation of phases of basement uplift and volcanic activity in the area of the Rhenish Massif could not be established. The inferred relationship of depositional and tectonic events indicates that a common kinematic framework existed during the polyphase development of the Rhenish Triple Junction and the Rhenish Massif from the Middle Eocene onwards.

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