Geophysical Research Abstracts, Vol. 9, 11118, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-11118

Constrains on the evolution of the Early Jurassic rifting in the western Southern Alps from stratigraphic analyses of the sedimentary succession of the Biellese area (Northern Italy)

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The Triassic-Jurassic succession of the Southern Alps reaches a thickness of about 5000 metres in the Lombardy Basin, but it rapidly thins out toward the west, where, west of the Maggiore Lake, it is represented by a lacunose succession no more than 500 m thick. The transition between the more subsiding and the less subsiding areas is sharp and occur along the well-known Gozzano paleohigh, bordered by syndepositional paleofaults that define the more subsiding eastern sectors (M. Nudo, M. Generoso and Iseo basins).
The sedimentary succession of the westernmost part of the Southern Alps is discontinuous and generally preserved in roughly north-south oriented structural depressions bounded on the eastern side by normal faults. The base is represented by Early Permian volcanics that cover the Hercynian basement. After a non-delpositional hiatus, during late Anisian deposition of coastal sandstones (1-5 m thick) occurred. The Anisian succession is covered by Ladinian inner platform dolostones up to 300 m thick. The top of the Ladinian platform records a subaerial exposure with development of “terra rossa” deposits and karstification. The absence of preserved Late Triassic sediments both in outcrop and as clasts in younger units suggests a non-deposition of the Late Triassic succession rather than its erosion. The Ladinian platform is directly covered by a late Pliensbachian-Early Toarcian succession consisting of basal shallow-water coastal sands that rapidly evolve to turbiditic sandstones and limestones. On the structural highs, the Jurassic sediments locally lay directly on the Permian volcanics (Gozzano), documenting a pre-Sinemurian erosional event that affects with different

intensity the structural highs and the more subsiding areas. On the Gozzoano high the Jurassic succession is represented by shallow water limestones (Late Sinemurian) unconformably covered by bioclastic red limestones that are interpreted as condensed paleohigh deposits (Late Pliensbachian).

The stratigraphic evolution of the western Southern Alps allows to recognize two main stages: the first is characterized by low sedimentation rates (Middle Triassic) and by significant hiatuses (Late Triassic-Early Liassic?) with respect to the eastern sectors, whereas the second (Middle-Late Liassic) is characterized by an extensional tectonic activity that led to the development of structural highs, with erosion of the Permo-Triassic succession, and depressions, where deep-water sediments deposited. The Liassic succession of the Southern Alps records therefore two extensional events that differs for position and age: the older one affects the Lombardy basin, between Maggiore Lake and Trento Plateau, whereas the second is recorded in the westernmost part of the Southern Alps. This evolution is ascribed to a shift in the crustal extension from east to the west: during late Triassic-Early Liassic the Gozzano-Fenera-Sostegno area represents the western narrow shoulder of an eastern rifting located in central Lombardy whereas during Middle-Late Liassic the extension migrates westward, causing the drowning of the former rift shoulder due to the opening of the Penninic Ocean. This situation strongly can be compared with the evolution of the Central Austroalpine during the Liassic, also characterized by a shift from east to west of the extension axes.