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Pre-Alpine Tectono-Stratigraphic Reconstruction of the Jurassic Tethys in the High-Pressure Internal Piedmont Zone (Stura di Viù Valley, Western Alps)

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Abstract: We present a detailed description of the tectono-stratigraphic architecture of the eclogite-facies Internal Piedmont Zone (IPZ) metaophiolite, exposed in the Lanzo Valleys (Western Alps), which represents the remnant of the Jurassic Alpine Tethys. Seafloor spreading and mantle exhumation processes related to the Alpine Tethys evolution strongly conditioned the intra-oceanic depositional setting, which resulted in an articulated physiography and a heterogeneous stratigraphic succession above the exhumed serpentinized mantle. "Complete" and "reduced" successions were recognized, reflecting deposition in morphological or structural lows and highs, respectively. The "complete" succession consists of quartzite, followed by marble and calcschist. The "reduced" succession differs for the unconformable contact of the calcschist directly above mantle rocks, lacking quartzite and gray marble. The serpentinite at the base of this succession is intruded by metagabbro and characterized at its top by ophicalcite horizons. Mafic metabreccia grading to metasandstone mark the transition between the "complete" and "reduced" successions. The character of the reconstructed succession and basin floor physiography of the IPZ metaophiolite is well comparable with the Middle Jurassic–Late Cretaceous succession of both the Queyras Complex (External Piedmont Zone) and the Internal Ligurian Units (Northern Apennines) and with modern slow-spreading mid-ocean ridges.

Keywords: tectono-stratigraphy; Piedmont Zone; metaophiolite; Western Alps; Alpine Tethys

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Citation: De Togni, M.; Gattiglio, M.; Ghignone, S.; Festa A. Pre-Alpine Tectono-Stratigraphic Reconstruction of the Jurassic Tethys in the High-Pressure Internal Piedmont Zone (Stura di Viù Valley, Western Alps). *Minerals* **2021**, *11*, 361. https://dx.doi.org/10.3390/min11040361

Academic Editor: Silvana Martin

Received: 1 March 2021
Accepted: 26 March 2021
Published: 30 March 2021

1. Introduction

During the rifting stage and seafloor spreading evolution of oceanic basins, the ocean floor commonly results the object of a strong tectono-stratigraphic mobility in response to the development of different types of active tectonic structures at different scales, such as extensional detachment faults, fracture zones, and transfer and tear faults (see, e.g., in [1–7]). The temporal and spatial development of these tectonic structures strongly controls the morphology of the oceanic basin, forming structural highs and lows that, in turn, influence the syn-extensional deposition, resulting in strong vertical and lateral facies and thickness variations (see, e.g., [5,8–18] and refrs. therein). The exposure of mantle rocks on the seafloor is also associated with serpentinization and ophicarbonation processes [7,19–21], which may form primary weakness horizons within the oceanic mantle.

During convergence tectonics both the intra-oceanic tectonic structures (i.e., extensional detachment faults, fracture zones, and transfer and tear faults) and the heterogeneous stratigraphy with its internal rheological contrasts (see, e.g., in [5,7–16] and references therein), represent, among others, important inherited weakness zones along which tectonic deformation commonly localizes (see, e.g., in [17,18,21–30]). Therefore, the tectono-stratigraphic reconstruction of the pre-orogenic oceanic basin physiography is highly significant to better constrain and understand the evolution of orogenic belts.