Kinematic evolution of the Malargüe fold-and-thrust belt at the Río Diamante (34º40' S.L.), Southern Andes of Argentina.

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The Malargüe fold-and-thrust belt is a thick-skinned belt in central-western Argentina developed during the Andean orogeny, related to the subduction between the oceanic Nazca and continental South American plates. The basement is mainly composed of pre-jurassic igneous rocks that are covered by Mesozoic marine and continental sediments of the Neuquén basin. Neogene volcanic activity and sedimentation contemporaneously with the mountain building allow us to infer the relative ages of major structures. Based on detailed field mapping, seismic and well information, three balanced structural cross-sections were made resulting an average shortening of 14.2 km (24%) for basement and cover rocks (Turienzo, 2008). Dating of pre and post tectonic volcanic and subvolcanic rocks (Baldauf, 1992; Giambiagi et al., 2005) allow us to postulate that the structures were significantly active from around 14.8 Ma to 2 Ma, which suggests a rate of shortening equal to 1.1 mm/year. Regionally in the studied area, two basement uplifts occur surrounding a central region where thin-skinned deformation prevails. At the west of this central region, three large basement wedges are observed related to thrust faults developed during Andean compression which propagate into the sedimentary cover along favourable horizons (commonly gypsum). These wedges transfer shortening to the cover rocks producing the thin-skinned deformation, which suggest a close spatial and temporal relationship between basement and cover deformation. In the thin-skinned region, the abundance of shales and salt horizons at the western sector facilitate the formation of tight folding while the more competent units placed at the eastern zone are deformed into duplex and imbricate thrusts. A more detailed analysis between the structures and the tertiary igneous rocks show that the deformation in the west sector was completed at 10.8 Ma, the oldest age of horizontal basaltic lavas (Giambiagi et al., 2005) covering the western structures. In the central thin-skinned region, the fact that the Sosneado thrust does not cut the Laguna Amarga intrusive (10.5 Ma, Baldauf et al., 1992) supports the hypothesis that cover deformation is related to the western basement structures and both were completely developed at that time. It represents an important middle Miocene compressive event (~2.5 mm/year) since 10 km of strata were shortened in approximately 4 Ma. After a high structural relief was formed faulting progressed toward the foreland in agreement with the critical wedge theory. In the eastern region, lack of detachment levels in the cover rocks made difficult the development of basement wedges and instead important backthrusting occurred. Several subvolcanic andesitic bodies (10.5 to 5.5 Ma) are placed over the backthrusting zone and thus their intrusion could be controlled by these antithetic faults (Turienzo, 2008). Further compression makes the main fault, named the Carrizalito fault, to propagate cutting toward the surface overthrusting pre-jurassic rocks onto tertiary synorogenic sediments. This deformation took place in the north and central areas before basalts overflow it (2 Ma) while in the southern area basement structures remain in the subsurface. Supercritical wedge geometry in the southern area as observed in the cross-section could be responsible of the actual seismicity registered there. A shortening of 4.2 km between 10.8 and 2 Ma (rate of 0.4 mm/year) suggests that Andean contraction becomes slow during upper Miocene-Pliocene times.

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