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Tectono-stratigraphic evolution of the northeastern sector of the Ñirihuau basin, north Patagonian Andes

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The Ñirihuau basin is located between 41° and 43° S at the eastern side of the Patagonian Andes. Its filling consists on a thick sequence of Oligocene to Miocene volcanic rocks (Ventana Formation) and Miocene volcaniclastic, clastic and carbonatic rocks deposited mainly in continental environments (Ñirihuau and Collón Curá Formations), which cover the previous ones. There is no generalized consensus about the origin of the basin. Some authors mentioned it as a typical foreland basin; others assigned a transtensional origin interpreting it as a pull-apart basin; or an extensional origin followed by a compressive regime.

The infill of this basin in the northern sector records, in the Ñirihuau Formation, the transition of different tectonics regimes. Based on a paleoenvironmental and provenance analysis performed on this unit along a section that follows the Las Bayas creek, and taking into account the regional geologic characteristics and the structural features that characterized the study area, we propose a model for the evolution of this basin sector, identifying the synrift, sag and foreland basin probable stages.

We interpret that very coarse alluvial deposits from the lower section of the Ñirihuau Formation correspond to a synextentional filling in small depocenters generated by normal faulting in the basement. The middle section starts with lacustrine deposits with extensional synsedimentary features, which is followed by a deltaic system and a second lacustrine section in the upper part. In this section of the unit we recognized the synrift climax and the beginning of the sag stage, that matches with a high sea level period. Finally, deposits of higher energy fluvial systems with synsedimentary deformation constitute the upper section of the unit. We interpret this palaeoenvironmental change as a forced regression that marks a change in the tectonic regime and the beginning of the foreland basin stage, related with the uplift and deformation of the fold and thrust belt to the west. This compression would have ended with the exhumation of basement blocks.

The tectonic switching mentioned before is also marked by the changes in the provenance sources. There is more participation of basic to intermediate volcanic lithics in the lower and upper sections of the unit, representing western sources, probably due to the initial phases of rifting (in the lower section) and from the fold and thrust belt at the top. There is also a subordinate participation of metamorphic lithics at the base, which indicates a contribution from the basement, favoured by the normal faulting from basement blocks. On the other hand, acidic volcanic lithics have more participation towards the middle section of the unit, together with the continuous contribution of basic and intermediate volcanic lithics. This input was interpreted to be from the Pilcaniyeu and El Maitén Volcanic Belt, respectively, at both sides of the basin, representing the most evolved stage of the rifting.

It should be noticed that along the Ñirihuau Formation, volcanic deposits from episodic eruptions, contemporary with the sedimentation, are repeatedly registered.