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Deciphering the geochemical and mineralogical changes of a Miocene sedimentary basin infill, Mendoza Province, Argentina

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Sediments deposited in foreland basins are accurate recorders of processes acting at different temporal and spatial scales during orogenic uplift. The effects of allogenic forcing on foreland sedimentation are well known at basin-scale, but uncertainties remain in deciphering and interpreting them at higher resolution, and in differentiating them from the sedimentary changes due to autogenic processes.

We present observations on the continental sedimentology and stratigraphy of the Central Argentinian Foreland. The majority of the basin infill is comprised by the Mariño Fm. and La Pilona Fm., which were deposited during the Miocene and cover almost 2000 m of stratigraphy. The large scale stratigraphy trend leads to interpret the entire alluvial system as a large fluvial fan that prograded over the proximal margin of the foreland basin. The basin infill records a continuous sediment supply from the rising Principal Cordillera and the first stages of the uplift of the Frontal Cordillera. The interaction of different allogenic forcing factors, but also autogenic processes, is recorded in the compositional changes of the sedimentary infill.

This project aims to provide a detailed reconstruction of paleoenvironmental dynamics and unravel the relative roles of climate and tectonics, using a high-resolution, integrated compositional and sedimentological analysis of the Mariño Formation and the basal part of the La Pilona Formation. The followed approach embodies the use of automated QEMSCAN technology, geochemistry, heavy-minerals and radiogenic isotope analysis.

Along 1500 m of stratigraphy we recognize compositional variations related to the evolution of the basin infill due to, at least, 5 phases of non-steady state conditions. Principal component analysis done with the major elements, main mineral phases and heavy minerals allow us to recognize the importance of the weathering and diagenesis in the total compositional variability. The A-CN-K ternary diagram displays low to moderate weathering values (CIA = 45-65) and shows the evolution of the composition towards the illite pole, in agreement with the QEMSCAN results. The evolution of the source rock composition shows a trend towards more mafic sources. La Pilona Fm. is characterized by more scarce composition certainly due to the advance of the thrust front coupled with inputs from the uplifting Frontal Cordillera, a tectonic province feeding the basin with different igneous sources. The integration of heavy mineral and isotopic data to constrain the source area changes will also allow us to have a better understanding of the evolution of the uplifting Andes.