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Tertiary volcanism and sedimentation in the southern Cordillera Principal, Mendoza, Argentina

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The tertiary sedimentation of the Cordillera Principal, to the south of the Province of Mendoza is characterized by a paleoenvironmental evolution responding to the tectonic evolution of the thrust and folded belt and to the volcanic evolution of the contemporary magmatic arc. This combination of events created a sedimentary and volcaniclastic column, which is briefly described below, including a stratigraphic classification. The studied sedimentary sequences as well as the contemporary volcanic bodies crop out to the south of the Province of Mendoza, from the Diamante River in the north to the Molle Caisson in the south.

Paleogene

Pircala –Coihueco Formation (Maastrichtian? – Thanetian)

The Pircala-Coihueco formation is distributed on a regional basis. This unit, as a whole, is characterized by a sequence of fine sandstones showing reddish to purplish colors. The lower limit is transitional with the Roca Formation and the upper limit shows a regional discordance that separates it from the Agua de la Piedra Formation. It shows three well-differentiated sections. The lower section shows interweaved pyroclastic levels (63.5 $\pm$ 3.2 to 58.4 $\pm$ 2.9 Ma, Parras *et al*, 1998 and Parras and Casadío 1999) that would belong to a fluvial system with a low to moderate sinuosity, which probably developed within the flooded plain; the mid section shows mature paleosoil levels that have been primarily eroded by gravelly fluvial systems. The tectosedimentary evolution of these deposits is due to the combination of volcanic arc activity, the Danian regression and an increase in the supply area, primarily in the mid and high-basin areas. Combina and Nullo (2002) recognize an intraformational variation within this Unit, positioning it at the paleosoil level; it would belong to the activity during the Incaic Phase. The arc was located to the west-southwest of the studied area (Mendez *et al,* 1995). The upper sector of this unit responds to the growth of the synorogenic prism, which in turn responds to the initial uplift pulses of this sector of the range, which is 55 Ma., as minimum.

Late Paleogene-Neogene

Molle and Huican eruptive cycles (CEM and CEH, Nullo *et al,* 2002)

Volcanism in the region started with an initial basaltic episode (CEM composed of Molle, Puntilla del Huincán and Palaoco Basalts) that was generated in the lower crust, which had a high concentration of gabbros, diorites and mafic granulites. Due to a thickening of the crust caused by the growth of the folded thrust belt or by the stagnation of magmas or by the combination of both processes, the formation of garnetiferous granulites resulted to be a distinctive product of the lower crust. The magmatic arc of the CEH (Andesitas Huincán and La Brea) was generated towards the Upper Miocene; the magmas climbed up from the mantle surface reaching a lower garnetiferous crust and losing its capability to climb up due to the absence of density contrasts and causing and

extended fusion, homogenization and rise process that was in equilibrium with the lower crust; this arc was characterized by this process.

Agua de la Piedra Formation (Early Miocene)

This Unit is an heterogeneous set, with variable thicknesses and clastic and volcaniclastic sedimentary paleoenvironments in reddish colors, which cover coalescent alluvial fans, fluvial systems and aeolian deposits (Combina, 1996), depending on the sector of the studied basin. Its lower limit is a regional discordance involving the period ranging between the mid Oligocene and the mid Miocene. (Nullo et al, 2004). This discontinuity was caused by the tectonic and magmatic action of the Pehuenche Phase and is covered by one level of andesitic conglomerates, which are informally recognized as *Rodados Lustrosos*. Combina *et al*, (1997), have positioned the sedimentary process creating these conglomerates between 20 and 22 Ma; they are the syntectonic deposit of the Pehuenche Phase. The sedimentary column shows the evolution of the thrust belt with coalescent alluvial fan levels, where tectonic activity has prevented their distal zones from developing in a normal manner. The presence of sand seas (Combina and Nullo, 2003) in small tectonic basins indicates moments of high generation of accommodation space. These sand seas, in relation to the absence of paleosoil levels, would indicate semiarid to arid climates as from the mid Miocene. The aridity of the climate in the mid and late Miocene was probably caused by the folded thrust belt that was already cutting the free circulation of humid winds from the west and the contemporary volcanic activity. The magmatic activity of the contemporary arc is evidenced by the Molle and Andesita Huincan Eruptive Cycles, which showed ages ranging between 17$\pm$ 2 and 12.4$\pm$0.7 Ma (Nullo *et al,* 2002). The activity of the Quechua Phase turned these units into tectonic units, thus causing the upper contact to be pseudo-concordant to discordant in other sectors.

Loma Fiera Formation (Upper Miocene)

The Loma Fiera Formation is made up by lapilli tuffs, agglomerates, tuffaceous sandstones and conglomerates in pink, gray and pale white colors, which were generated by a sequence of primarily dry pyroclastic flows and their correlated lahars (Combina and Nullo 2000). It discordantly lies on the Pircada-Coihueco and Agua de la Piedra Formations. Baldauf (1993) and Baldauf *et al*, (1997), indicate a Tortonian age (10.5$\pm$ 1.0 and 10.0 $\pm$ 0.2 Ma). Vergara *et al* (1995) considered this Unit as deposited in a compression and fault-reactivation environment during the evolution of a foreland basin and as contemporarily generated by the volcanism of the contemporary arc that was already located in the studied area.

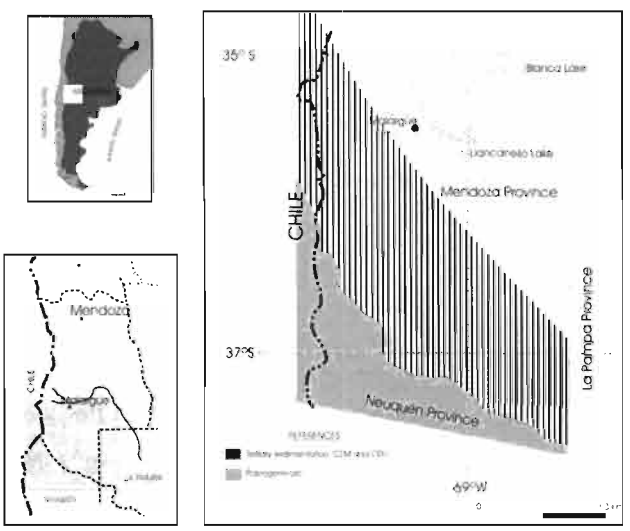
Pincheira Formation (Upper Miocene)

This Formation is made up by a sequence of tuffs, agglomerated tuffs and volcanic agglomerates of an andesitic to rhyolitic composition, with a yellowish to whitish color and with a covered base and roof, which is locally transitional with the Río Diamante Formation. Combina *et al*, 2000, interpreted it as a powerful volcanic and volcaniclastic set, related pyroclastic flows with subordinated fluvial and laharic systems. Dating efforts regarding the levels of this unit have shown an age of 10.8 $\pm$ 0.8 Ma, indicating that it deposited contemporarily with the Loma Fiera Formation, and both are the synsedimentary answer of the arc's activity. The magmatic arc

is represented by andesitic bodies belonging to La Brea Andesite, of the Huincán Eruptive Cycle (Nullo *et al*, 2002), with an age ranging between 10.7 ± 0.5 and 5.9 ± 0.3 Ma, and which is located within the studied area.

Río Diamante Formation (Late Miocene – Pliocene?)

The Río Diamante Formation is a sequence of hazel or very light brown volcaniclastic sandstones and reddish conglomerates with a thickness of over 120 m. Its upper contact is transitional with the Loma Fiera Formation. These deposits have been interpreted as medium to distal sequences of alluvial fans, with subordinated ignimbritic, laharic and Aeolian levels, the evolution of which is fully related to the last uplift pulse of the El Sosneado overthrust (Combina, 1996; Combina and Nullo, 1997 and 1999) and to the late activity of the Huincán Eruptive Cycle. The stratigraphic position of this Unit has not been completely clarified, though formations), its upper sections, primarily of continental sedimentation, date from the Pliocene, and it may have experienced intraformational discordances due to the action of the Diaguita phase; the tertiary sedimentation process experienced by this sector of the Cordillera Principal ended with this tectonic phase.probably its lower sections, which feature a higher degree of volcaniclastic and ignimbritic events, date from the late Miocene (contemporary to the posthumous activity of the arc and to the Loma Fiera and Pincheiras



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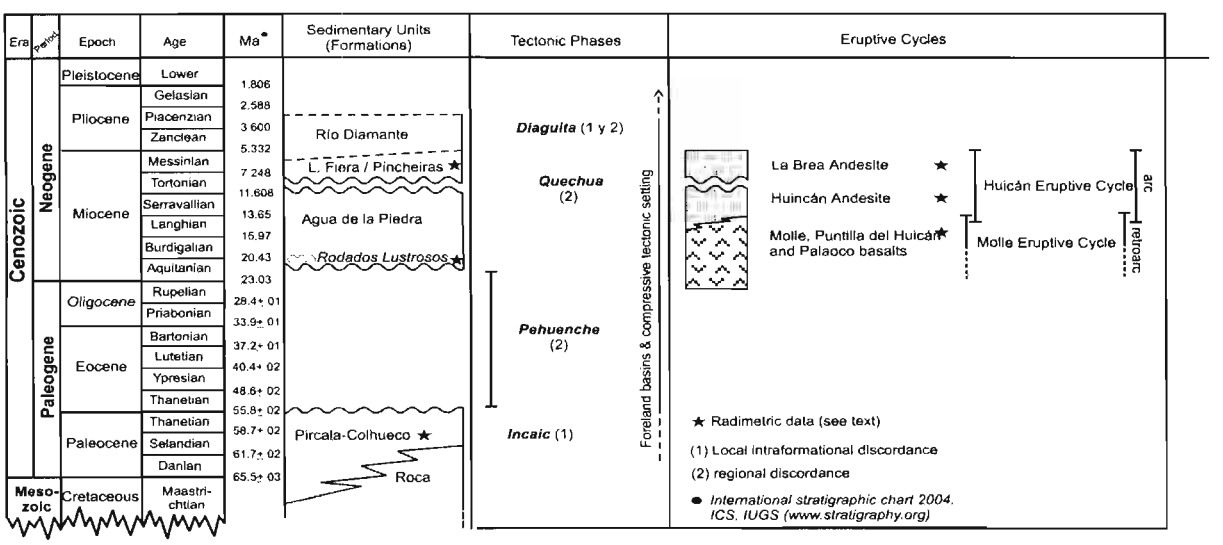

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