

**The Purilactis Group of Northern Chile:  
Link between arc and backarc  
during Late Cretaceous and Paleogene**

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### Resumen

El Grupo Purilactis, de aproximadamente 3000 m de espesor y delimitado por discordancias angulares, abarca la Fm. Tonel (areniscas, yeso), la Fm. Purilactis (conglomerados, volcanitas), y la Fm. Yesífera Superior. Este grupo se depositó en una cuenca de tras-arco muy cercana al arco magmático del Cretácico superior hasta el Eoceno superior.

**Key words:** Paleogene, Salar de Atacama, magmatic arc, backarc, orogen-parallel strike slip faults.

### Introduction

The Purilactis Group, exposed along the escarpment at the western border of the depression of the Salar de Atacama (Fig.1), forms a thick sequence of red continental clastics with volcanic intercalations. It rests unconformably on the late Paleozoic Agua Dulce and El Bordo Fms., and is unconformably covered by the gravels of the Oligocene - Middle Miocene Tambores Fm.. Its stratigraphy, structure and paleogeological relations are under discussion (Ramírez & Gardeweg, 1982; Filint et al., 1989).

### Stratigraphy and Structure

The Purilactis Group (s.l.) is a continuous sequence that can be subdivided into three lithostratigraphic units (Fig.2):

a) Tonel Fm.: This lowermost formation of the Purilactis Group can well be studied in a section in the southern part of the area represented in Fig. 1 (loc. pur1, pur2). There, it rests with a low angle unconformity on a thick, dark grey vesicular lava assigned to the Agua Dulce Fm. The 20 m thick basal member consists of a massive sandy breccia with dark volcanic limestone fragments (5 m) at the base, and an alternation of fine breccias, grey micritic limestones and fine red sandstones and siltstones. It ends with a conglomeratic level containing limestone fragments. The following main part, approximately 1500 m thick, is formed by alternating members of thick gypsiferous sandstones with large cross-bedding, red nodular and gypsiferous mudstones, red sandstones and thin conglomeratic layers. Limestones are intercalated only with the lower part. The top of the Tonel Fm. consists of 20 m of alternating orange coloured mudstones and gypsiferous sandstones, some of which containing isolated pebbles.

b) Purilactis Fm. (s. str.): The base of the conglomeratic Purilactis Fm. generally is sharp, although the first conglomerates may alternate with the orange coloured mudstones. In nearby sections, the sequence starts with 20 m of limestone cemented conglomerates and limestones, followed by a green tuffaceous level. In the described area, the Purilactis Fm., approximately 1000 m thick, is built up, from bottom to top, by (1) a brown conglomerate with clasts consisting of red sandstone, intrusive rocks and possibly Jurassic limestones (550 m), (2) a red conglomeratic breccia with fragments of breccia, tuff, sandstone and porphyric rocks (350 m), (3) an orange red conglomerate with well rounded igneous cobbles (10 m) and (4), near the top, a volcanic member with porphyric lavas.

c) Fm. Yesífera Superior: In the southern part of the study area represented in Fig.1, the conglomerates of the Purilactis Fm. grade into coarse sandstones and fine grained breccias containing gypsiferous layers. The limited occurrence of these sediments does not allow recognition of further stratigraphic relationships.

Although rapid variations in lithology and thickness are common in the Purilactis Group, its subdivision is easily recognizable, also beyond the limits of the studied area. The distribution of volcanic layers and hypabyssal intrusions is irregular in time and space, and locally magmatic rocks may become a dominant feature (e.g. in the westernmost exposures and near loc. pur3 and pur4 in Fig.1). Nevertheless, the volcanic level near the base of the Purilactis Fm. is very continuous.

The Purilactis Group was deposited in a continental, arid environment. The sandstones of the Tonel Fm., partly rich in gypsum, show a distal alluvial fan facies. The conglomeratic facies of the Purilactis Fm. represents sedimentation in a proximal alluvial fan environment. The clastic material was supplied by intermittent rivers from the west where the volcanic arc of that time was situated in a relatively elevated position. The abrupt onset of the conglomeratic sedimentation of the Purilactis Fm. and its connection with volcanism reveals an expansion of the magmatic and tectonic activity of the arc region.

As fossils of stratigraphic significance are lacking, the age of the Purilactis Group was debated. New data were obtained by Döbel, 1989, by means of the Ar/Ar method. Samples from pyroclastic intercalations with the basal member of the Purilactis Fm. at two different locations (Fig.1:

pur3 and NE of pur2) gave  $44.0 \pm 0.9$  Ma and  $43.8 \pm 0.5$  Ma. Thus, a Middle and Late Eocene age can be assigned to the Purilactis Fm. s.str. The question arises whether the underlying Tonel Formation has its base still in the Upper Cretaceous. In this respect, it is tempting to correlate the basal limestones of the Tonel Fm. with the Yacoraité Fm. in NW-Argentina. If this assumption proves to be true, the Purilactis Group corresponds to the Balbuena and Sta. Barbara Sub-Groups of the Salta Group (Marquillas & Salfity, 1988), notwithstanding some differences in facies.

Eastward thrusting of the late Paleozoic substrate over the Purilactis Group determines its structures. In the northern part, the Paleozoic rocks were pushed upwards in such a way that the basal members of the Purilactis Group were uplifted and turned up to an upright position, while the upper members are now found to the east in topographically deeper positions. In the southern part of the study area, the Paleozoic rocks were thrust over upper members of the Purilactis Group. Eastwardly verging folds and several secondary thrusts run through the group itself. No cleavage was developed. Local diapirism can be observed in gypsum-rich parts of the Tonel-Fm. An important feature are N-S directed dextral strike slip faults which are revealed by vertical folds which were developed in upturned strata (Fig.1). These and the shortening structures did not affect the Tambores Fm. and thus are prior to the Mid Oligocene.

### Conclusions

The Purilactis basin was situated immediately to the East of the magmatic arc of that time whose volcanic products (Chile-Alemania Fm) were deposited, without intervening sediments, directly upon a probably elevated area that had underwent tectonics during the Late Cretaceous. The paleogeographic position of the Purilactis Group between arc and backarc is underlined by the interdigitation of sediments and andesitic volcanics, which are completely lacking in the sediments of the Salta Group in Argentina. According to Reutter & Scheuber (1989), dextral, orogen-parallel strike slip faults are a characteristic feature of the tectonics, of the Late Cretaceous - Paleogene magmatic arc which then was situated in the Precordillera of this region. The presence of such structures in the Purilactis area does connect it to the magmatic arc, while the likewise present thrusts and folds facing to the east are a feature of backarc tectonics.

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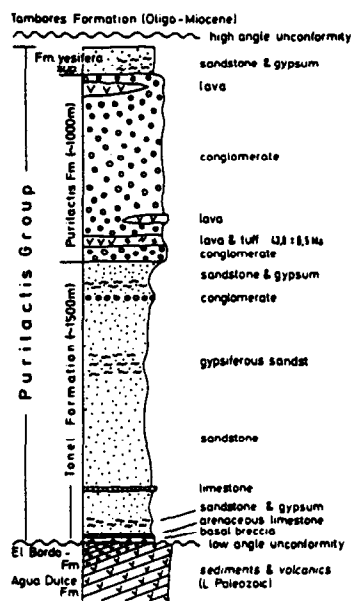
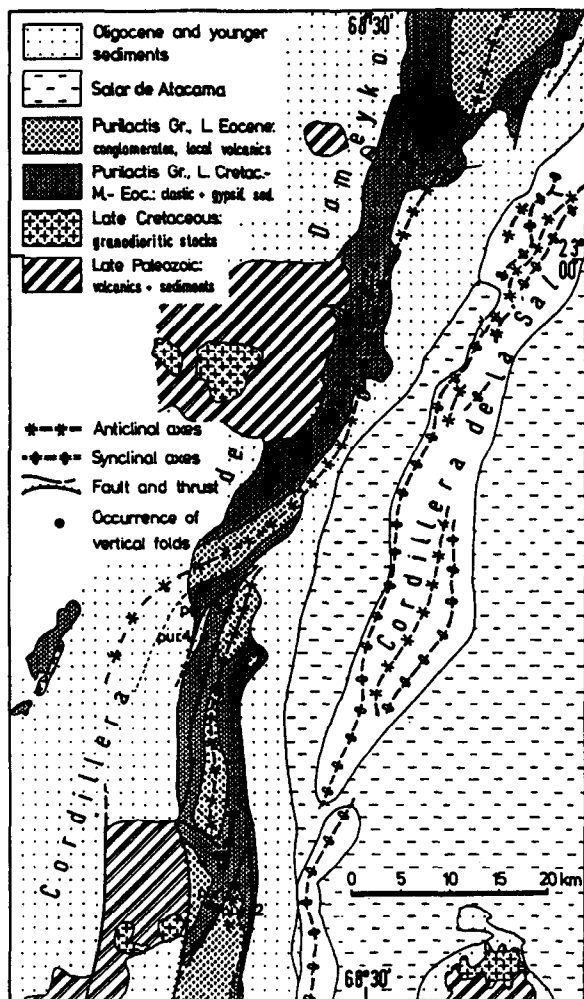


Fig.2: Stratigraphic column and subdivision of the Puritactis Group near the southern border of the study area (Fig.1).

Fig.1: Geological and structural sketch map of the study area at the western border of the Salar de Atacama near 23° S.