GEOTECTONIC DEVELOPMENT OF THE EARLY PALAEOZOIC GONDWANA MARGIN IN NORTHWESTERN ARGENTINA

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RESUMEN: Durante el Paleozoico Inferior, el desarrollo magmático, sedimentario y tectonometamórfico del Noroeste Argentino dependía de la interacción entre el continente de Gondwana en el este y placas oceánicas Paleopacíficas en el oeste. Después de haber sido margen pasivo al límite Precámbrico/Cámbrico, este se transformó en un margen activo, temporalmente presentando un arco de islas con cuenca trasarco.

KEY WORDS: Argentina, Gondwana, Pacific Plates, Early Palaeozoic, Terranes

INTRODUCTION

The nature of the Early Palaezoic Gondwana margin in the southern Central Andes has been discussed controversially. On the one hand, a fairly monotonous development along a continuing ocean border was thought to be evident (MILLER 1984), and the collision of exotic terranes like "Chilenia" (RAMOS et al. 1986) were postulated; on the other hand, "Laurentia" (DALLA SALDA et al. 1992) while moving northward, alongside the coast of South America, should have left traces at the Gondwana margin.

Field work within the Pampean Ranges, the Famatina System and the Precordillera (Fig. 1) was done in cooperation with the University of Tucumán (F.G. ACEÑOLAZA, A. J. TOSELLI, J. ROSSI DE TOSELLI) and numerous co-workers who helped to a better understanding of the orogenic processes developed at this continental margin. Their cooperation is gratefully acknowledged. However, misinterpretations committed in the text below should be ascribed to the author alone.

GEOLOGICAL SETTING

The beginning of the Palaeozoic history of the southern Central Andes is characterized by the subsiding sedimentation and the beginning of deformation and metamorphism of the Puncoviscana Formation in Northwestern Argentina (Pampean Cycle; ACEÑOLAZA et al. 1990a). The southern exten-

sion of this orogen remains unclear; possibly it ends at lat. 30° S, while the southern Pampean Ranges, at least in parts may belong to an older orogenic cycle. In this case northern and southern Pampean Ranges would represent two different terranes, welded together before the Ordovician.

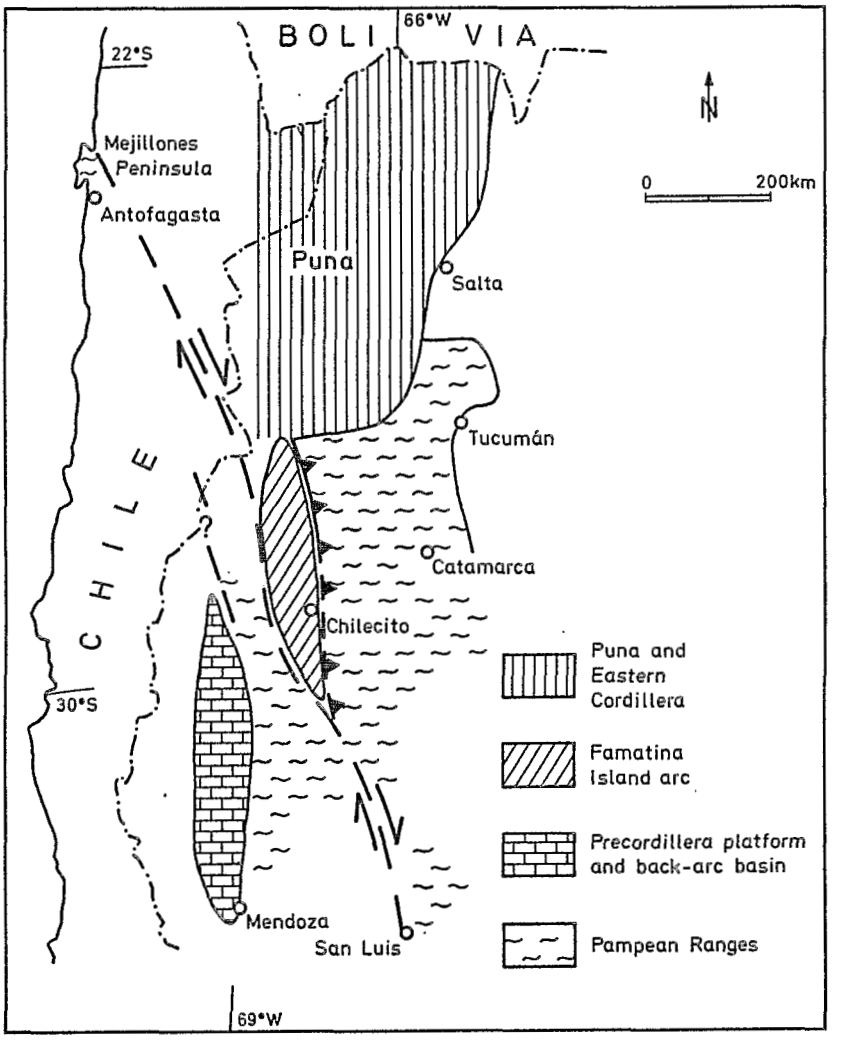

Fig. 1. Terranes in NW Argentina. The Precordillera/Eastern Pampean Sierra terrane is the most allochthonous; it moved dextrally up to 800 km to the north, if Mejillones Peninsula is included within this block.

Ordovician granitoids are widespread within the Pampean Ranges (RAPELA et al. 1992), while Precambrian magmatism is, up to now, poorly known, and Cambrian intrusives are documented only from two localities (BACHMANN et al. 1987).

On the other hand, Ordovician volcanism played an important role in the Precordillera, the Famatina Range, in the Puna and in the Eastern Cordillera. In these areas, a Cambro-Ordovician island arc - back-arc basin

evolution was accomplished by the closure of the basin in mid Palaeozoic times. In the area east of the Famatina Range the back-arc basin was to a large extent overthrusted by the Fiambalá Range and other Pampean Ranges after the Ordovician.

Within this puzzling frame, the Famatina System is a foreign element. The eastern and western borderlines of the Famatina system that apparently represents an exotic Ordovician island arc, placed between typical Pampean Range terranes at both sides, and a carbonate platform further to the west, were formed in a different way. To the east, a former back-arc basin is only preserved as remnants, including basic magmatics, marbles and calc-silicate rocks in the eastern slope of the Sierra de Fiambalá. Mostly it has disappeared underneath the westward driving Pampean Ranges. To the west, a thin slice of Pampean Range-type rocks slid along the Island arc, together with the carbonate platform of the Precordilleran system. ACEÑOLAZA & TOSELLI (1988) explained its present position assuming a large dextral transcurrent fault to the west of the Famatina system. This model was later extended to the north, including the Mejillones Peninsula within the slice of Western Pampean Sierras (ACEÑOLAZA et al. 1990b).

Thus, the Precordillera of Mendoza, San Juan and La Rioja and the Famatina System are defined as fragments of the same island arc - back-arc basin system which developed at the western edge of Gondwana. West of the Precordillera the island arc has been covered by younger rocks or may partly be present in metamorphic metabasalt-metasediment series of the Chilean High and Coastal Cordillera. East of the Famatina system, only small remnants of the back-arc basin remained at the western slope of the Fiambalá Range as slices of early Palaeozoic oceanic magmatic rocks, calc-silicates and mica-schists.

The composition of syn- and postsedimentary magmas changed from magmatic arc to syn-collisional in character with time (SCHÖN 1991, MANNHEIM 1992). The diversity of the western border of Gondwana can neither be explained only by assuming a micro-continent collision nor only by continent-parallel gliding of slices of continental crust, nor only by persistent and homogeneous subduction processes. In fact, this complexity results from a variable stress field, controlled by various Palaeopacific oceanic plates which collided with the continent at variable angles, producing transpressional and transtensional tectonics as well as right-angle collisions of parautochthonous island arcs with their continental hinterland.

CONCLUSIONS

In the Eastern Cordillera as well as in the Famatina Range a continuous development from island arc to collision type magmatism has been found. Repeated extension and collision seem to be typical features of the Gondwana margin in the Palaeozoic. The northward movement of a small slice of crust, comprising the Precordillera and parts of the Pampean Ranges, destroyed an Ordovician island arc; this transcurrent fault must therefore be younger than the island arc itself. The all over present Ordovician magmatism belongs geotectonically to the subduction episode that produced the island arc. Magmatism diminished in the Devonian, and revived once more in the Carboniferous. This probably gives a hint to the

time of dextral shearing in the Devonian, and to a revival of subduction in the Carboniferous.

For all these processes, subduction of oceanic Palaeopacific plates is needed which were moving continentwards under varying angles. In this scenario there is no room for a continuously northward gliding Laurentia continent alongside South America during the Early Palaeozic.

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