PREANDEAN GEOTECTONIC SETTINGS OF SOUTHWESTERN SOUTH AMERICA

Luis H. Dalla Salda [1] , Monica G. López de Luchi [2] , Carlos Cingolani [1] and Ricardo Varela [1]

(1) Centro de Investigaciones Geológicas. Calle 1 N° 644. 1900 La Plata. Argentina

(2) Centro de Investigaciones en Recursos Geológicos. J. Ramírez de Velasco 847. 1414 Buenos Aires Argentina

Key Words: Preandean-Tectonic setting-Occidentalia-Famatinian Belt

East of the Andean Cordillera, three major geotectonic units contributed to the pre Gondwanic crustal evolution of southwestern South America. From west to east they are: the Precambrian Occidentalia Terrane that crops out along both edges of the Andes as highly tectonized blocks, the Late Precambrian-Middle Palaeozoic Famatinian Orogenic Belt, which comprises the Pampean Ranges, the Puna and the North Patagonian Massif and the Precambrian westernmost Rio de la Plata-Brazil-Southern Africa cratonic area .Occidentalia and the Famatinian Orogenic Belt have been yuxtaposed as a result of Middle Ordovician (ca. 460 Ma) Laurentia-Gondwana collision (Dalla Salda et al, 1992 a,b). Several narrow discontinuos basic-ultrabasic belts dated as late Precambrian to Lower Paleozoic exist west of the more granitized Famatinian belt.

Occidentalia is composed by metamorphic and granitoid rocks (several radiometric ages indicate Grenville ages) trending nearly north-south mostly along the western side of the Famatinian Orogenic Belt, form northernmost Chile to Patagonia. It includes the Chilenia terrane (Ramos et al., 1986) and is partially covered by the Precordillera Cambrian to Tremadocian carbonate platform, recently accepted as a terrane of Laurentia provenance (Dalziel et al., 1996).Dalla Salda et al. (1992 a,b) and Dalziel et al.(1994) interpreted it as a relic of eastern Laurentia detatched after the Taconian collision during Iapetus closure.

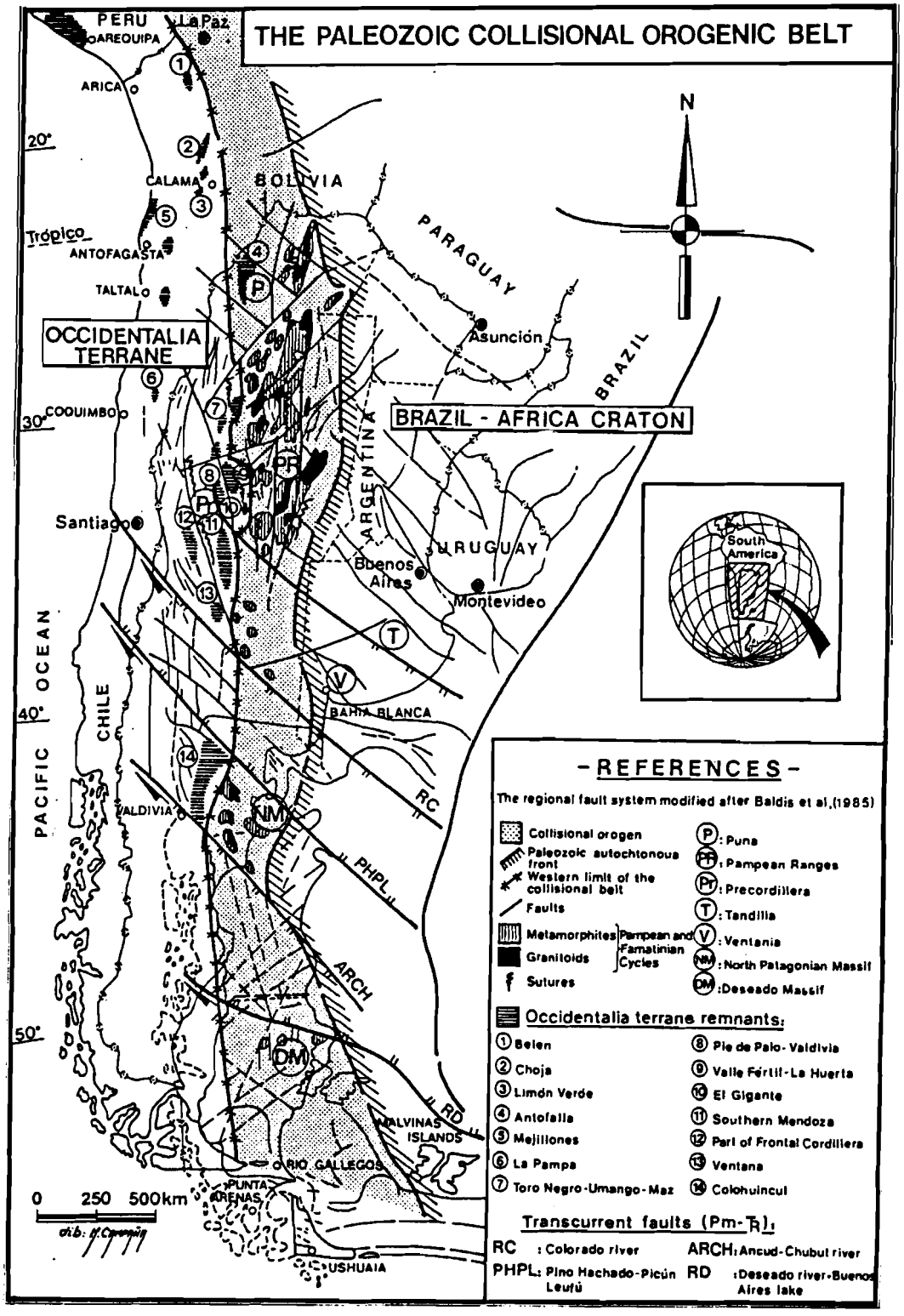
The **Famatinian Orogenic Belt** is a complex metamorphic-igneous belt whose evolution covers the span from late Proterozoic to Devonian and includes two distinct metamorphic and plutonic cycles, Pampean and Famatinian in the Eastern Pampean Ranges.*Pampean Cycle* covers a span from Late Proterozoic (640 Ma) to Lower Cambriam (530-540 Ma) and it includes metamorphic and igneous rocks.In the Eastern Pampean Ranges, scattered outcrops of trondjhemitic to tonalitic granitoids and metaigneous rocks (metanorites) older than 520 Ma has been asigned to this cycle (Rapela et al., 1990). A low grade metamorphic event is associated. The ca. 550 Ma limit Pampean/Famatinian Cycle is very

difficult to set. Tilcarica deformational event, which affects the sin-rift sequences of the Puncoviscana Formation to the north of the Pampean Ranges, could be pointing out to the change in the geotectonic regime along the western margin of Gondwana. Since a rift separated Gondwana from Laurentia from Late Proterozoic (750Ma) on (Dalla Salda et al, 1992a, b), sometime between the rift-drift regime and the generation of the Famatinian active margin, a major change to a convergence regime would have happened. A continuous subduction regime installed along the western margin of Gondwana from the Cambrian;diacronous opening could explain magmatic arc signature coeval to passive margin affinities or more tholeithic compositions closer to the inferred spreading center.

Famatinian Cycle (520-360Ma) comprehends an extensive period of metamorphism and igneous activity with peaks of metamorphic and igneous activity.This cycle can be considered as equivalent to G2 granitoids (Rapela et al, 1990); D2 and D3 deformational domains (Dalla Salda,1987) are related to the Famatinian evolution. D2 involves NNW structures,it is essentially a ductile deformation associated to the higher metamorphic grade and migmatitization. Peak metamorphic temperatures seem to postdate D2 (due to tectonic uplift). D3 is a higher crustal level episode with an associated retrogradation. Three main groups of granitoids are distinguished on the basis of geochemical features and their relation to D2 and D3 deformational events:a pre-Taconic group,a Taconic group and a late Taconic (Acadian) group(Lopez de Luchi and Dalla Salda, 1995).

Pre-Taconic granitoid group(520-460 Ma) is represented by medium to small granitic plutons or polifacial batholiths with sligthly discordant to concordant contacts, moderately to highly strained. This magmatism like calc-alkaline, metaluminous to peraluminous and have and arc-like signature. If the Pre-taconic granitoids of the Famatina Arc are considered, an Andean type arc system parallels a coeval more mature arc inwards the eastern continent.Meanwhile in the Eastern Pampean Ranges, Pre-Taconian granitoids are intruded in metamorphic rocks, in the Famatina Arc, they are intruded in metasedimentites and metavulcanites. Volcanism associated to Lower Ordovician sedimentary basins, appears in north and central Famatina Arc and the Puna. Gabroids considered as roots of a magmatic arc emplaced in granulites appears in Sierra de Ancasti and Sierra de Fiambala. Famatinian Lower Ordovician granitoids are poorly defined in the Famatina. Continental arc signature corresponds to Taconian ages (460-440Ma); being so, a magmatic Famatinian arc would be coeval to collisional granitoids inward the continent. Subduction process could have continued locally during the collision because of the irregular shape of the continents (the Famatina and the Puna magmatic arcs).Resetting of older ages might be an alternative explanation at least for a part of the Famatina Arc since 460-440 Ma ages are mostly K/Ar mica ages in moderately deformed rocks or Rb/Sr whole rock ages in granitoids with different geochemical signature (i.e. in Paiman Ranges).

Taconic granitoid group (460-440 or 420 Ma) include syntectonic plutons concordant to regional structures or in a complex relation to the polyphasial deformation in the orogen. All of them share collisional signature. Trace element inter-element relations show a marked Rb enrichment(Lopez de Luchi



Southern South America Famatinian Orogenic Belt showing the main units referred to in text. Also shown is the Occidentalia Terrane with the Lower Paleozoic Precordillera belt .Continental megafractures (considered as Permo-Triassic), shifting the Famatinian Orogenic belt are represented.

and Dalla Salda, 1995).Taconic granitoids are associated to a granitic migmatitization unlike the tonalitic migmatitization of the Lower Ordovician rocks. Crustal thickening, overthrusting and ramp tectonics associated to continent-continent collision overlap different structural levels. Regional controlling structures of the Lower Ordovician plutons are NNW-SSE (except for San Luis Hills).

Late-Taconic granitoid group (440 to 420-360) is characterized by large batholiths like Achala, Capillitas, with a more syenogranitic composition, NNE fault controlled emplacement and contact aureoles or smaller ellipsoidal plutons (Batolito de Renca, Batolito de Las Chacras-Piedras Coloradas) that are predominantly monzogranites to syenogranites. The former are peraluminous to sligthly peralkaline crustal granites but share a collisional to within plate trace element signature. The latter are metaluminous to middle peraluminous, richer in MgO with a mixed mantle and crustal signature.During the Devonian, granitoid signature, metamorphism, structure and paleogeographic reconstructions allowed to interpret a dextral transpresive Laurentia-Gondwana collision (Dalziel et al.,1994). Granitoid plutons emplaced at an epizonal environment indicates post-Ordovician uplift.Peri-orogenic syn to postcollisional sedimentary basins formed as a consequence of this uplift.

As it has been already stated (Dalla Salda et al.,1996, GSA, Austin) if Occidentalia was part of eastern Laurentia, it is feasible to suggest that the Appalachians-Ouachitas-Marathon and Occidentalia-Precordillera-Famatina Orogenic Belt may fit in a single geotectonic setting .

References

Dalziel, I.; Dalla Salda, L.H. and Gahagan, L.M., 1994. Paleozoic Laurentia-Gondwana interaction and the origin of the Appalachian-Andean mountain system. *Geol. Soc. Amer. Bull.*, 106, 243-252

Dalziel, I.; Dalla Salda, L.H and Cingolani, C. and Palmer. P. 1996.The Argentina Precordillera: A Laurentia Terrane? Penrose Conference Report, *GSA Today* , 16-18

Dalla Salda, L., 1987, Basement tectonics of the southern Pampean Ranges. *Tectonics*, 6, 3:249-266.

Dalla Salda, L.; Cingolani, C. and Varela, R. 1992a. Early Paleozoic orogenic belt of the Andes in South America: Result of Laurentia-Gondwana collision. *Geology*, 20, 616-620.

Dalla Salda, L., Dalziel, I. ,Cingolani, C. and Varela, R. 1992b. Did the Taconic Appalachians continue into South America? *Geology*, 20, 1059-1062.

Dalla Salda, L.; Cingolani, C.; Varela, R. and Lopez de Luchi, M.G., 1996. Taconian Laurentia-Gondwana Collision: Evidence from a Geological Fit. *Geological Society of America. 30th Annual Meeting, Abstracts with Programs*, N° 38742,10, Austin, Texas.

Lopez de Luchi, M.G. and Dalla Salda, L.H.,1995.Some Pampean Pretaconic and Famatinian Taconic Granites of Southwestern South America. In Brown, M and Piccoli, P M. (eds) The Origin of Granites and Related Rocks, Thrird Hutton Symposium. Abstracts. U.S. Geological SurveyCircular 1129, 91.

Ramos, V., Jordan,T., Allmendinger,R., Mpodozis, C, Kay, S., Cortés, J and Palma, M., 1986, Paleozoic terranes of the central Argentine-Chilean Andes. *Tectonics*., 5, 855-880

Rapela, C.; Toselli, A.; Heaman, L. and Saavedra, J. 1990 , Granite plutonism of the Sierras Pampeanas; An inner cordilleran Paleozoic arc in the southern Andes.In Kay, S.M. and Rapela, C.W.(eds.): Plutonism from Antarctica to Alaska. *Geol. Soc. Am., Spec. Pap.*, 241, 77-90