Proterozoic and paleozoic evolution of Atlantic area of North-Patagonian Massif, Argentine

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This contribution comprises partial results of the CNPq-CONICET International Cooperation Project, which studies the crustal evolution of the northern Patagonia during the Precambrian to Paleozoic times. It also provides information for the relationship between the so called South American Platform and Patagonian Platform, the former being consolidated at the end of the Precambrian, whilst the latter suffered recurrent tecto-thermal activities up to the Cenozoic.

According to the scattered outcrops of the basement rocks, the study region can be divided into three areas (Fig. 1): Yaminué-Nahuel Niyeu area; Mina Gonzalito-Sierra Pailemán area; and Sierra Grande-Punta Sierra area.

At Yaminué-Nahuel Niyeu area the basement consists of two rock associations put together by thrusting[1]:

- i) An infracrustal association (Yaminué Complex) of alternating schist-gneiss-foliated granite. The intrusion of the granites occurred syn- kinematically respect to the main folding event. Parcially foliated and concordant porphyritic granodiorites were emplaced during the late stages of deformation. The structural pattern of the succession is characterized by NW verging overturned folds (with low-angle axial planes) and mylonitic belts[2]. One Rb-Sr errochron made with different rock types yielded an age of 620 ± 45 Ma (IR: 0.7038 ± 0.0520), while an isochron of 680 ± 27 Ma (IR: 0.7018 ± 0.0010) was obtained for the late-kinematic granodiorite[3]. Also for the same granodiorite a Sm-Nd TDM model age of 1.310 ± 0.043 Ga was obtained. Presently, the U-Pb zircon dating is being performed.

- ii) A supracrustal association of low to very low grade metamorphism, the Nahuel Niyeu Formation, mainly composed of metagreywackes, slaty shales and phyllites, with minor metadiabase. The structure is the result of three phases of deformation, and the main phase determined the SW verging asymmetric and tight folding[4]. A reference isochron made upon phyllites[5] yielded an age of 600 ± 25 Ma (IR:0.70347).

At Mina Gonzalito-Sierra de Pailemán area the two successions described, Mina Gonzalito Gneiss and El Jagüelito Ectinite[6] are respectively correlated with Yaminué Complex and Nahuel Niyeu Formation. Again here the contact between them is of tectonic character (transcurrent faulting). Quartz-biotite schists, biotite gneiss, muscovite and garnet bearing S-type foliated granites concordant to the metamorphic structures, amphibolites and marbles were recognized for Mina Gonzalito Complex[7]. The Rb-Sr isochron obtained for this unit was of 850 ± 50 Ma (IR: 0.70734)[5], and its protolith was interpreted[8] as a passive margin association, composed of dolomites and limestones, greywackes and shales, and also basic to acidic lavas, which underwent successive deformation and metamorphism. At present, additional Rb-Sr and U-Pb datings are in process on gneisses and granites from this Complex. The El Jagüelito Formation is mainly composed of quartz phyllite grading into metagreywacke, and quartz-biotite-clorite bearing phyllite. Neopaleozoic granites (Pailemán Granite) are also important in this area, while Middle Jurassic felsic volcanics (Marifil Formation) make up large plateaux.

The basement rocks of Sierra Grande-Punta Sierra area comprises only the low grade metamorphics comparable to El Jagüelito Formation. They are intruded by granitic to granodioritic plutons (Punta Sierra Granite, Arroyo Salado Granodiorite), and both together are unconformably overlain by Silurian sedimentary rocks containing invertebrate fauna (Sierra Grande Formation). This Silurian unit is folded and faulted, and the existence of some thermal contact effects led to the recognition of post-Silurian intrusions. Former datings for these granitoids were a K-Ar age of 435 ± 20 Ma[9] on Punta Sierra Granite, and Rb-Sr ages[10] of 453 ± 23, 505 ± 15 and 613 ± 68 Ma.

In this contribution we present five new Rb-Sr isochrons for plutons of this area, with the following results (Fig.2): For outcrops of seashore area and its surroundings an isochron of 483 ± 22 Ma (IR:0.7043 ± 0.0013) was obtained for leucogranites of Punta Sierra, another one of 467 ± 16 Ma (IR:0.7081 ± 0.0004) for granodiorites and granites of Arroyo Salado Granodiorite, and an errorchron of 409 Ma (IR:0.7077 ± 0.0060) for leucogranites of Las Grutas. From the outcrops close to Hiparsa Mine (Fe), to the south of Sierra Grande, the ages obtained are 363 ± 57 Ma (IR:0.7110 ± 0.0022) for a pink granite (Mina Hiparsa Granite), and 318 ± 28 Ma (IR:0.7070 ± 0.0004) for Laguna Medina Granodiorite. The field relationships together with the obtained data are consistent with igneous activities during Lower, Middle and Upper Paleozoic times.

According to the evidences exposed above, we can preliminarily interpret for the crustal evolution of the Atlantic area of the North Patagonian Massif an oldest tecto-thermal activity during the Proterozoic Brazilian Cycle, and later activities during Lower to Middle Paleozoic Famatinian Cycle, and also during Neopaleozoic to Eomesozoic Gondwanic Cycle.

The main tectonic events for this crust should have occurred during the Brazilian Cycle, as evidenced by the infracrustal successions with overturned foldings and low-angle mylonite and shear zones typical of nappe and thrust structures. On the other hand, the chemical studies of the supracrustal quartz greywackes[11] point to felsic and intermediate volcanics of orogenic origin (Continental Island Arc of Active Continental Margin) as source of the detritus. Based on the above mentioned elements, we consider this supracrustal unit as syn-orogenic flysch-like deposits. The exhumation of this basement terrane is considered to happen before the deposition of the Silurian sediments.

In the regional scale, other remnants of Neoproterozoic basements are found to the north, at Sierras Australes of Buenos Aires (Ventania), while at Sierras Septentrionales (Tandilia) during the Brazilian Cycle sedimentary rocks in foreland situation cover unconformably the Transamazonian basement. The most complete Proterozoic evolution of the region is found at the Uruguay - Rio Grande do Sul Shield, where Don Feliciano (Cuchilla Dionisio) Belt surrounds the Rio de la Plata Craton to the east[12]. Paleozoic plutonic activity, similar to those identified at North Patagonian Massif, can be also mentioned to the north of this area at the Chadileuvu Block, separated by the Cretaceous Colorado Basin. There, low grade metamorphics of undetermined age are intruded by undeformed granitoids, one of which yielded a Rb-Sr isochron of Lower Devonian age[13], and older granitoids without precise ages are also present.

We consider that the Neoproterozoic continental paleogeography that characterizes the Brazilian Cycle of Brasil and Uruguay can be traced to the south through the Atlantic region up to at least approximately 42°SL. At northern Patagonia the Brazilian tectomagmatic cycle was followed by other sedimentary, magmatic and structural processes during the whole Paleozoic times. These Famatinian and Gondwanic activities are today recognized without much important superimposed metamorphism, except those accompanying some mylonitic belts, both at North Patagonian Massif and Chadileuvu Block.

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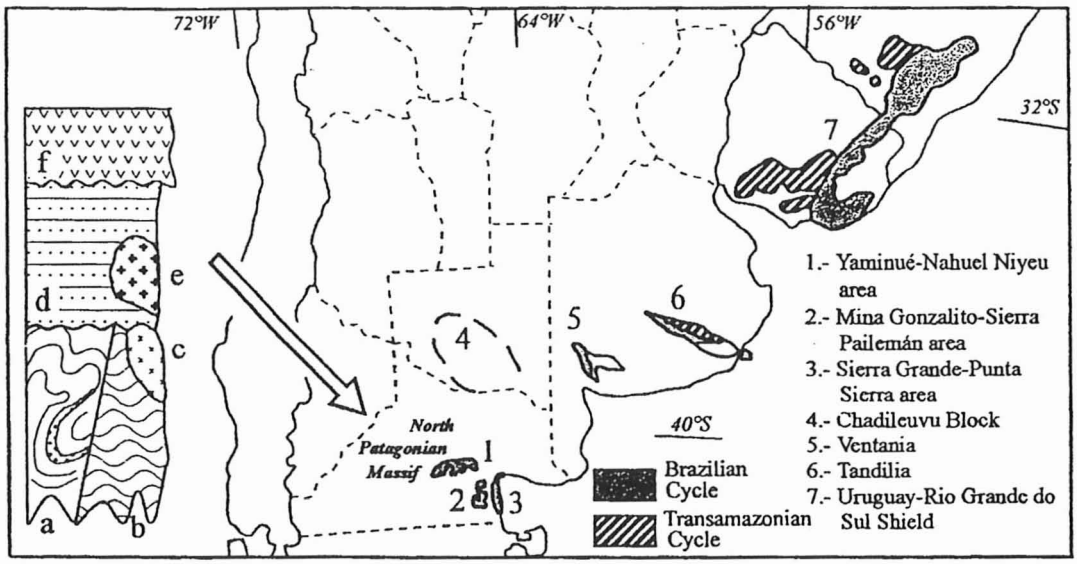

Fig.1.- Regional sketch of Neoproterozoic-Paleozoic outcrops of the Atlantic area. **a)** Neoproterozoic Infracrustal association; **b)** Neoproterozoic supracrustal association; **c)** Eopaleozoic granitoids; **d)** Silurian sedimentary cover; **e)** Middle to Late Paleozoic granitoids; **f)** Jurassic volcanics.

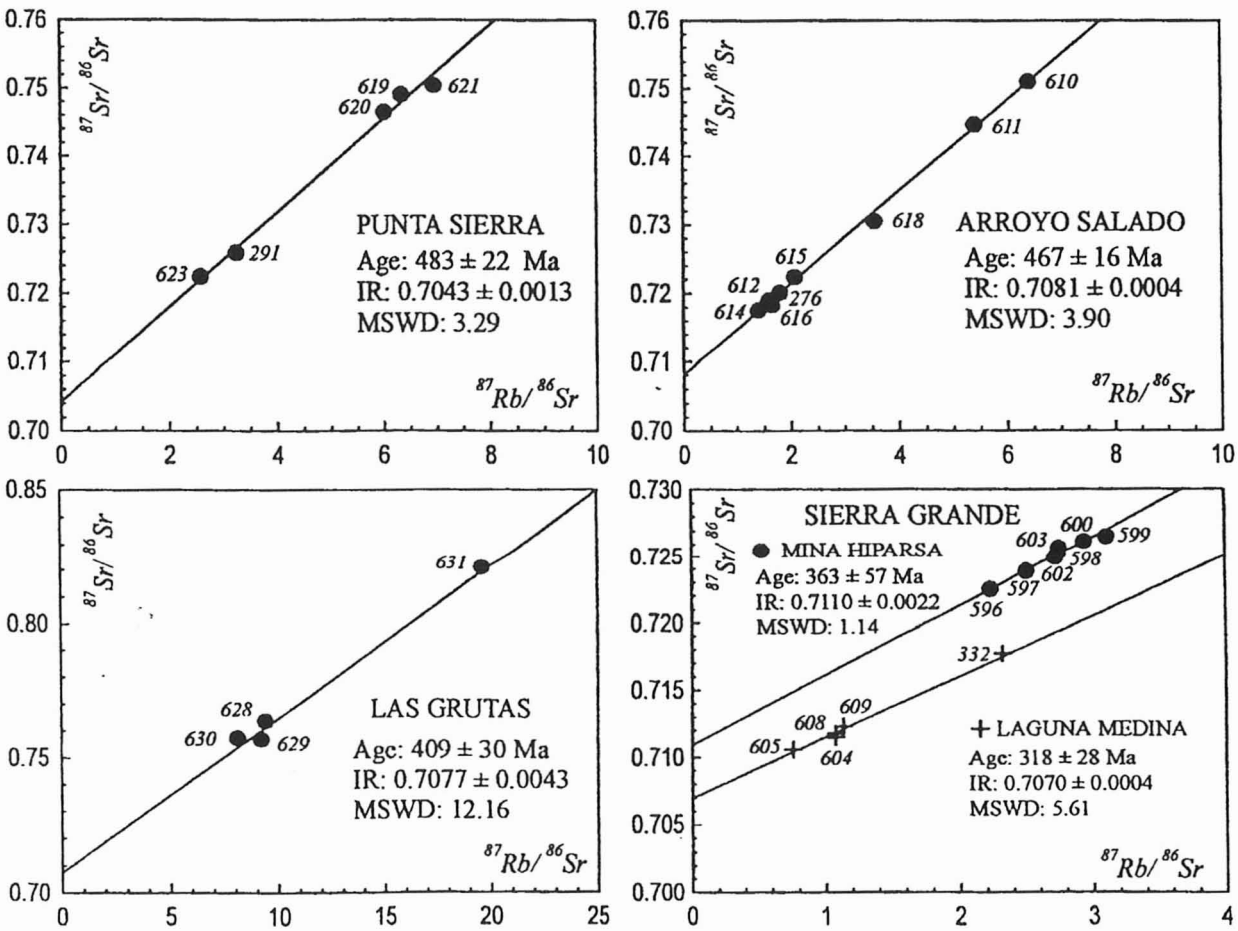

Fig. 2.- Rb-Sr diagrams (Williamson) for granitoids of Sierra Grande-Punta Sierra area, North Patagonian Massif.