AN INSIGHT INTO THE STRUCTURAL EVOLUTION OF THE SIERRA DE SAN LUIS (SOUTHEASTERN SIERRAS PAMPEANAS, ARGENTINA): A PROGRESS REPORT

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INTRODUCTION

The Early Paleozoic metamorphic basement of the Sierra de San Luis (Eastern Sierras Pampeanas) is characterized by a large volume of Ordovician to Devonian granitoids. Late Carboniferous continental basins constrain the upper limit for ductile deformation and granite intrusions. Previous studies (e.g. von Gösen and Prozzi, 1996, 1998; Sims *et al*., 1997, 1998) have shown that the basement complex is composed of three different units, which are regarded to represent the tectonically assembled southwestern margin of Gondwana. From west to east those are the Nogoli, Pringles and Conlara Metamorphic Complexes, respectively. Additionally, those basement units are separated by two narrow stripes of low grade phyllite interlayered with greywackes, quarzites and meta-volcanics (San Luis Formation, Prozzi and Ramos, 1988). All three basement units are composed of high grade metamorphic gneisses and migmatites together with amphibolites and mafic to ultra mafic rocks, the latter restricted to Pringles and Nogoli Metamorphic Complexes (Fig. 1).

Up to now only scarce constraints on the peak metamorphic conditions within the different units were reported (e. g. Ortiz Suárez *et al*. 1992, Llambías *et al*., 1996, von Gosen and Prozzi, 1996, Hauzenberger *et al*., 2001 and references therein). Therefore, the separation into an eastern and western basement complex (von Gösen and Prozzi, 1998) that is mainly based on structural arguments (e.g. von Gösen and Prozzi, 1998; Sims *et al*., 1998), could be rather weak in the light of our recent observations. A different approach in order to support the separation of the basement complex based on crustal residence times (Sato *et al*. 2001) has been presented.

Although the previous studies have contributed to define an important geological knowledge, there are still basic questions such as the timing of the different events, the clear separation between the pre-Famatinian, syn- and post-Famatinian deformation, the relation between granites, metamorphic evolution and regional deformation that remains open.

Our ongoing investigation is focused on the structural and metamorphic evolution of the basement and the included granitoids. In this contribution we present the first structural results of the observations along two west-east profiles (Fig. 1).

PROGRESS REPORT

In order to reconstruct the metamorphic and magmatic history of the Sierra de San Luis, structural investigation is focused on two cross sections (Fig. 1). From WNW to ESE the northern profile follows the road from San Francisco via La Carolina and Cerros Largos to

Paso Grande (A-A'), whereas the southern profile connects Nogoli via Paso del Rey with Los Membrillos (B-B'). Both profiles comprise the basement complex including a number of granitoids that have been previously considered as pre- to syn-kinematic. Additionally a more intensive mapping of the central area east of the la Escalerilla Granite is being performed.

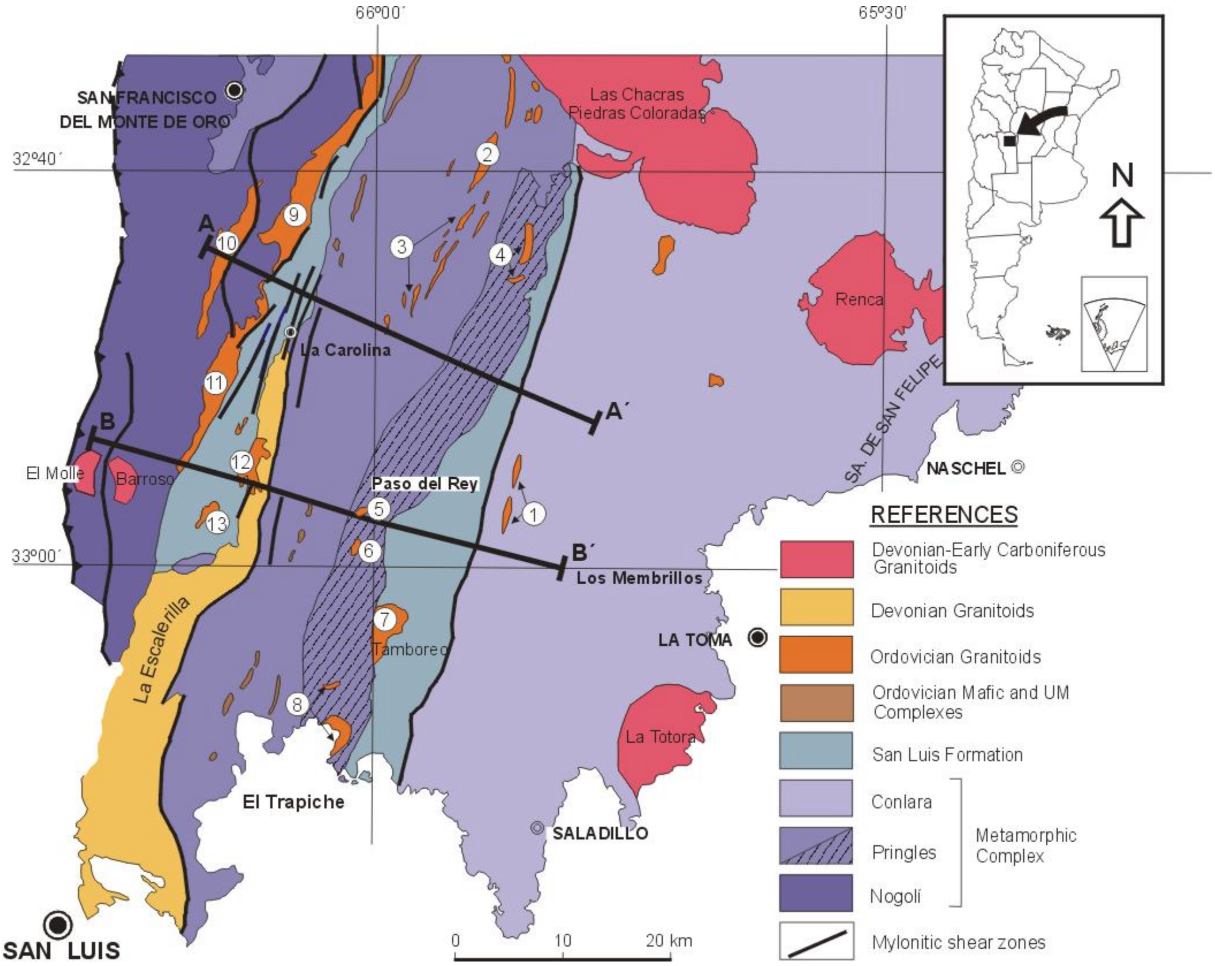

Figure 1: Schematic map of the Sierra de San Luis Paleozoic units (based on López de Luchi 1993, von Gösen and Prozzi, 1998, Sims *et al*., 1998 and references therein). Numbers indicate plutons as follows: 1) Río de la Carpa granite, 2) Cruz de Caña granite, 3) Cerros Largos granite, 4) La Capilla granite, 5) Paso del Rey (north), 6) Paso del Rey (south), 7) Tamboreo tonalite/ granodiorite, 8) La Florida granite, 9) San Miguel granodiorite, 10) Río Claro granite, 11) Gasparillo Tonalite, 12) Las Verbenas tonalite, 13) Bemberg tonalite.

Along those profiles, although most of the granitoids are foliated, the origin of this foliation is still a matter of discussion. The style of deformation (magmatic vs. solid-state) and foliation development within the spatial and temporal separated plutons, will provide important time constraints in the structural and metamorphic evolution of the different basement units. Within this context, the correlation between deformational phases and granite emplacement, especially for those plutons intruding the low grade phyllite units, would yield a key position in the reconstruction of the structural history of the basement. From a petrological point of view, the relationship of widespread migmatites and granite genesis is still unsolved. Migmatites may indicate an arrested stage of development in which leucosomes did not represent large scale-bodies or may result from contact effects induced by neighbouring plutons. Alternatively, migmatites and granites cannot be genetically related.

In a similar way the emplacement of several generations of a huge amount of pegmatitc melt remains unclear. Pegmatites are generally regarded as the latest stage magmatic activity after pluton emplacement. A different explanation for the generation of pegmatitic melt may be the in situ segregation from a sedimentary pile with a critical water content. For the widespread pegmatites no assignment to the different magmatic events exists.

The timing of peak metamorphic assemblages and crystallisation ages of the different plutons will provide detailed information on the P-T-t evolution of the basement complex.

Additionally, vertical displacement is indicated by crustal scale mylonitic faults, probably leading to a variable cooling history of the basement blocks.

FIELD OBSERVATIONS

Along the A-A´ profile, north of La Carolina (Fig. 1), the transition from the western phyllite belt towards the higher grade metamorphic rocks of the Pringles metamorphic Complex is less continuous than in the eastern belt. Here the phyllites grade rapidly into a sequence of migmatites interlayered with quarzitic gneisses. A high amount of mylonitic rocks in between both rock types, seems to accomodate a high amount of vertical displacement. Kinematic indicators generally point to an east side up displacement with minor strike slip component.

In the area south of La Carolina, towards the south of the A-A´ profile, the transition between the western phyllite belt and the higher grade mica schists and gneisses of the Pringles Metamorphic Complex is largely hidden by the Devonian La Escalerilla Granite (Fig. 1). This pluton leads to a contact metamorphic overprint of the phyllitic rock located to the west, indicating its high intrusion level. The pluton exhibits a high-T solid-state foliation, which partly grades into a penetrative mylonitic foliation along its eastern margin. The difference in the metamorphic grade at both sides of the pluton has to be explained by some vertical displacement. Kinematic indicators support also an east side up displacement of the Pringles Metamorphic Complex.

Along the A-A´ profile, within the western phyllitic belt as well as along the eastern border to the Nogoli complex, a series of tonalitic to granodioritic plutons are assumed to predate the regional deformation of the phyllites (von Gosen and Prozzi, 1998 and references therein). Our observations indicate distinct mylonitic zones of a few cm width along the border of one of those plutons, that may indicate that the host was relatively cool during the emplacement of the magma.

Field observations along the B-B´profile, from the eastern contact of La Escalerilla Granite towards Los Membrillos, indicate that the central part of the Pringles Formation comprises two main units. To the west the basement is composed of migmatitic mica schists interlayered with more gneissic or quarzitic rocks showing a variable degree of migmatisation. In the Paso del Rey area, this heterogeneous assemblage changes to a homogenous sequence of fine grained biotite gneisses, which are assumed to represent the "micaschist-group" of von Gösen (1998). At Paso del Rey (Fig. 1), the interlayering of these biotite gneisses and the above mentioned heterogeneous assemblage could indicate their common folding. In a west-east direction, sillimanite bearing biotite gneisses are replaced by garnet-biotite and biotite muscovite bearing gneisses. The intensity of migmatisation within these biotite gneisses decreases strongly towards the east. Both basement units, the more heterogeneous and the gneisses, are invaded by a huge amount of pegmatitic melts, which could be separated in at least two generations on the basis of their structural relation with the host rock. One generation is parallel to the foliation and shows at least marginally, a solid-state foliation, whereas a second generation, crosscuting the pre-existing structures (either folds or foliations), lacks internal deformation (see López de Luchi *et al.*, 2002 this congress).

Further towards the east two mica gneisses (in part the micaschist group of von Gösen, 1998) grade continuously into the phyllitic rocks of the San Luis Formation (see also von Gösen 1998). This transition is assumed to represent a continuous metamorphic sequence.

In the profile B-B´, within the Pringles Metamorphic Complex, the general NNE–SSW striking penetrative foliation is the result of the intense tight to isoclinal folding of the former D1 structures. Those folds show wavelengths on a max. scale of some hundred meters. Within the western part axial planes of the D2 folds are sub vertical, while further to the east axial planes are highly inclined towards the west. D2 fold axis plunge slightly to the north.

In contrast to the observation of von Gösen (1998) also within the eastern phyllite belt, and their metamorphic equivalents a polyphase deformation has been detected. The first deformation event is represented by steeply plunging fold axis. The second folding event results into NNE-SSW trending fold axis.

DISCUSSION

Our preliminary observations point to transitional contacts between Pringles Metamorphic Complex and the eastern belt of the San Luis formation and a displacement of this metamorphic complex that should be contemporaneous or slightly postdate the emplacement of the Devonian La Escalerilla Granite. Therefore we at present do not argue for a separate metamorphic evolution for the phyllites and the Pringles Metamorphic complex.

In the so called pre-kynematic plutons located to the north of La Carolina, mylonite along the borders of the pluton indicate a relatively cool country rock that may indicate either an upper crustal level of intrusion or a tectonic yuxtaposition.

Additionally, the cooling history of the different basement complexes and plutons should be constrained by different dating methods (see López de Luchi et al. 2002, this congress). The latest stage of cooling should be unravelled by K/Ar-mica dating, while the peak metamorphic conditions could be obtained by Sm/Nd-techniques. Since sillimanite grows parallel to the stretching lineation, the latter method will yield the age of the regional deformation. The comparison of the metamorphic peak ages over the whole basement complex will indicate whether deformation took place before or after juxtaposition of the individual complexes. Furthermore, Sm/Nd-model ages are supposed to constrain the individual or common history of the basement.

In order to proof if the high-grade metamorphic rocks and the phyllites have a common deformation history the latter will undergo detailed K/Ar dating techniques. Also a large time gap between crystallisation and cooling ages for some so called pre-kinematic plutons that are published up to now will be revisited.

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