Syn-kinematic magma ascent and batholith inflation (Sierra de San Luis/Argentina) *Vortrag*

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The measurement of the anisotropy of the magnetic susceptibility (AMS) is now routinely used since more than four decades in the analyses of rock fabrics in granitic rocks (e.g. Stacy 1960, Henry 1975, Gleizes et al. 1993). Even though the intensity of fabrics in granitoids is often weakly developed the significance of orientation and shape of crystals is the same like in other deformed rock types. By revealing the distribution of fabrics in plutonic rocks one of the still ongoing discussions in granite tectonics may be addressed: How did those sometimes voluminous batholiths were inflated in the middle crust? We are presenting magnetic fabric data on a series of Devonian batholiths that intruded the polyphase deformed metaclastites of the Sierra de San Luis (32°10′– 33°20′ S / 65°15′ – 66°20′ W) in central Argentina. Regional considerations on the tectonic regime during the emplacement of the batholiths are inferred from combined field, microstructural and AMS observations.

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Geological background

The proto-Andean basement outcropping in the Sierras Pampeanas experienced a polyphase magmatometamorphic history during the Ediacaran/Early Palaeozoic resulting from the accretion of different crustal fragment to Gondwanas southwestern margin (Ramos 1988). The final manifestation of this history is the emplacement of voluminous, elliptical granodioritic to syenogranitic composite batholiths in the Sierra de San Luis and the Sierras de Córdoba during the Early/Middle Devonian (Fig. 1).

There exists discordance on the regional stress field that enabled the magma ascent during this period. According to Llambías et al. (1998) the Devonian magmatism is the result of the collapse of the Famatinian orogen whereas Sims et al. (1998) emphasised the relation of the Devonian batholiths with the continual subduction followed by the collision of the Chilenia Terrane with the western outboard of Gondwana.

The Devonian batholiths

Detailed fabric studies on the largest batholiths in the Sierra de San Luis, i.e. the La Totora, Renca and Las Chacras-Potrerillos batholiths were carried out. The studies comprised systematic field surveys, microstructural observations and anisotropy of magnetic susceptibility (AMS) measurements. Microstructural studies indicate that the batholith rocks are mainly characterised by magmatic microstructures with limited sub-magmatic to high temperature sub-solidus deformation. Magmatic foliations are defined by the planar arrangement of tabular feldspar and biotite. The local appearance of intracrystalline fractures in the feldspar filled

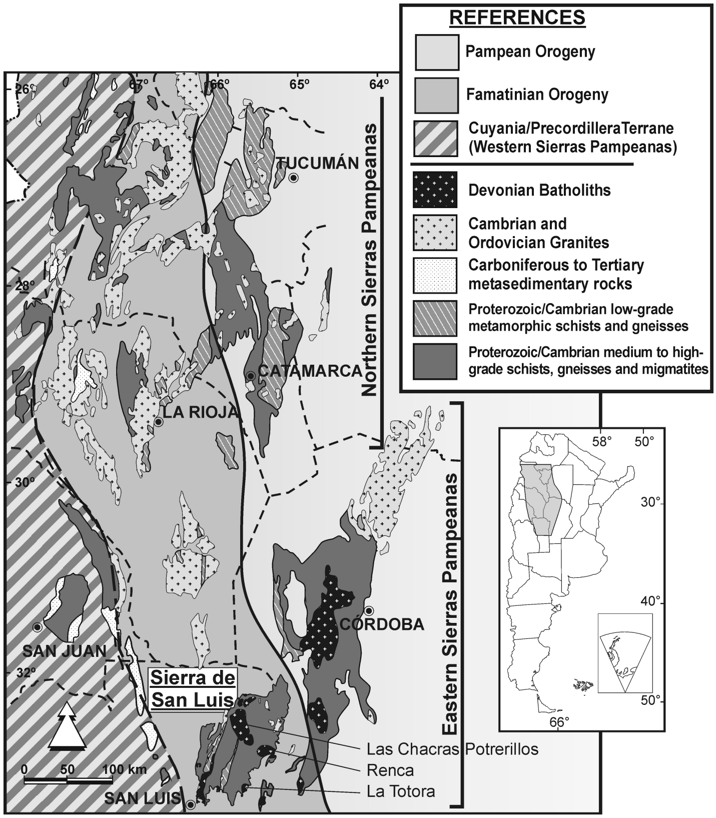

Figure 1: Schematic map of the southern section of the Sierras Pampeanas. The Devonian magmatism is restricted to the basement complexes of the Sierra de San Luis and the Sierras de Córdoba

with fine-grained granitic melt point to the syn-kinematic emplacement of the batholiths. Continued deformation below the solidus is accommodated by feldspar recrystallisation as indicated by sub-grain boundaries. Recrystallisation of quartz at low temperatures, leading to the formation of quartz ribbons is observed in the SE sector of the Las Chacras-Potrerillos batholith only. Shear indicators point to sinistral as well as dextral sub-horizontal displacement. All three batholiths possess concentric foliation patterns that along the margins show a steep inclination. The average magnetic foliation patterns in the studied plutons agree well with the macroscopic fabrics measured in the field indicating that the AMS-data can be used to study the orientation of fabric elements. However, a bulk susceptibility (K_{vol}) of up to 8000×10^6 in almost all granitic sub-units indicates a predominance of ferromagnetic contributions to the bulk susceptibility. Therefore biotite fabrics of selected samples were used to calculate a theoretical AMS tensor (Siegesmund et al. 1995) that was

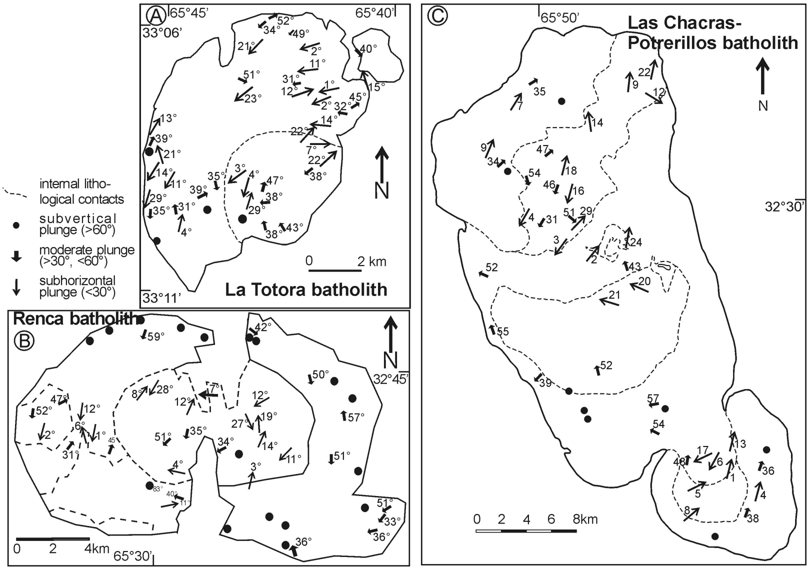

Figure 2: Orientation of magnetic lineations for the La Totora, Renca and Las Chacras-Potrerillos batholiths. Note that except for the marginal part of the Renca batholith, most lineations tend to be sub-horizontal or shallowly plunging.

compared to the measured AMS fabric, indicating acceptable accordance in the directional data but do not necessarily support the shape of the magnetic fabric ellipsoid. Most foliations and lineations reflect magmatic flow and their attitude is linked to the interference between regional deformation and batholith inflation, i.e. fabrics may be due to regional strain in combination with the internal dynamics of the magma bodies. Magnetic lineations either are sub-vertical or follow the NNE–SSW trend that is also documented by the linear fabrics of their hosts (Fig. 2).

Results

It is proposed that the opening of transtensional pull-apart structures controls those shallow dipping lineations during batholith inflation. K/Ar and Ar/Ar muscovite data from regional shear zones at ~360 Ma (Sims et al. 1998, Steenken et al. 2004) support the idea of a syn-kinematic magma ascent and batholith inflation following the direction of extension in a transpressional tectonic framework (Fig. 3). It turns out that the Devonian batholiths intruded the basement syn-kinematically with respect to the Achalian deformational cycle.

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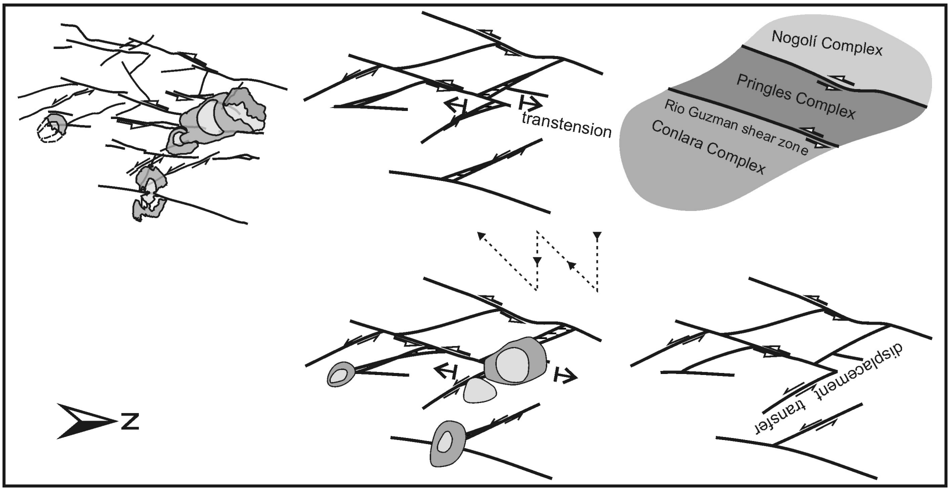

Figure 3: Comic strip illustrating the syn-tectonic emplacement of the major Devonian granitoids in the Sierra de San Luis. Schematic depiction of the major tectonic strike slip faults connected with the 'space-creation' for the magma ascent. The development of a secondary set of NNW trending sinistral strike slip faults leads to the counter clockwise step over of the sinistral displacement along the Río Guzmán and related NNE–SSW trending shear zones. NNE directed crustal extension would allow the formation of magma conduits and subsequent magma accommodation in a transtensional setting.

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