GRANULITE FACIES METAMORPHISM IN CRYSTALLINE BASEMENT AND ULTRAMAFIC ROCKS IN THE SIERRAS PAMPEANAS RANGE, PROVINCE OF SAN LUIS, ARGENTINA

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The Sierras Pampeanas, located in the Province of San Luis, Argentina, trends NNE–SSW from latitude 32° to 34° south. The area comprises of a Precambrian to Lower – Middle Paleozoic high grade metamorphic basement (granulite facies metapelites, migmatites and orthogneisses), phyllites, including mafic and ultramafic units and pegmatites.

The stongly deformed quartzo-feldspathic metapelites make up the main lithological unit. Mafic and ultramfic units are found as lenticular concordant bodies of up to several 100 meters in length. Recent gravimetric and magnetometric measurements as well as field work have shown that under the crystalline basement the extension of the ultramafic rocks covers a wide area. Orthogneisses and pegmatites are younger in age in respect to the crystalline basement but form mostly concordant bodies. Phyllites are separated from the basement by brittle faults.

Phase petrological observations as well as geothermobarometric calculations indicate granulite facies metamorphism with a subsequent strong retrograde equilibration in the crystalline basement as well as in the ultramafic rocks. Metapelites can be divided into two groups, depending on the grade of reequilibration. The granulite facies mineral assemblage is characterized by garnet - sillimanite - biotite - k-feldspar - plagiclase - quartz ± cordierite. Calculations of the PT conditions of the assemblage garnet - cordierite - biotite - sillimanite with the BERMAN 1988 database and using garnet thermometry and garnet – sillimanite – plagioclase – quartz barometry, gives values of 750° ± 50° C and 5 ± 1 kbar. The reequilibrated mineral assemblage consists of garnet – muscovite – biotite – plagioclase – quartz ± staurolite. Temperature and pressure, using garnet thermometry and garnet – sillimanite – plagioclase – quartz barometry, calculated for this mineral assemblage ranges from 500° to 600° C and 4 to 5 kbar. Garnets of both mineral assemblages do not show any zonation pattern but rims towards biotite are slightly enriched in iron. Mixed CO_2 and H_2O fluid inclusions in quartz indicate for the granulite facies metamorphism an activity of H_2O which is significantly lower than 1.

The ultramafic rocks comprise mainly of 1) orthopyroxene – amphibol – plagioclase ± clinopyroxene ± biotite ± chromite ± sulfides and 2) olivine + chromite + sulfides. Orthopyroxene – clinopyroxene thermometry yields two different groups of temperatures, depending on rim or core compositions used for the calculations and the grade of reequilibration of the rock. The highest temperatures of about 750° to 850°

C (calibration of LINDSLEY 1983) are found in fresh rocks using core compositions. Rim compositions as well as core compositions of orthopyroxenes which were slightly altered to amphibole along cleavages and along the rims give temperatures of 600° to 650°C.

Based on field observations and the similarity in metamorphism in metapelites and ultramafic rocks we conclude that both units underwent the same granulite facies metamorphism with a subsequent equilibration to amphibolite facies. Homogeneous mineral compositions (with the exception of retrogressive effects of the outermost rims) and the lack of disequilibrium textures indicate that this area suffered only a single metamorphic cycle of granulite to amphibolite facies conditions.

LINDSLEY, D. 1983: Pyroxene thermometry. Am. Min. 68.

BERMAN, R.G. 1988: Internally-consistent thermodynamic data for minerals in the system Na_2O – K_2O – CaO – MgO – FeO – Fe_2O_3 – Al_2O_3 – SiO_2 – TiO_2 – H_2O – CO_2. J Petrol. 29: 445 - 522.