METAMORPHIC GRADE CHARACTERIZATION OF POLANCO MARBLES, URUGUAY

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ABSTRACT: The marbles that widely outcrop on the Polanco region have been historically recognized on the Uruguayan geological literature. Despite this fact the main studies made on this unit are focused on the skarns around granitic intrusions, but the knowledge about regional metamorphism of these rocks is scarce, and even prevail doubts about its existence. This study focuses on the regional metamorphism of this unit, through optical petrography, microtectonics and SEM characterization of the minerals. The rocks are fine-grained calcite marbles and associated discrete levels of calc-schist. The last ones have granonematoblastic and granoblastic domains. The former domains are composed of Cal+Qtz+Ab+Tr+Phl+Ep+Op. They have a strong foliation, in which calcite and quartz grains undergo pinning by tremolite and phlogopite, these last minerals also compose pressure shadows on albite crystals, which contain small epidote inclusions. The last domains are coarse grained lenses, composed of calcite, that show grain boundary migration and type III twins, chevron shaped twins, subgrain rotation and other deformation features. Quartz ribbons and boudins were also recognized. They show a granoblastic texture, diffuse grain boundary and subgrains. Scanning electron microscopy using a JEOL 5900 Low Vacuum with coupled NORAN EDS, located at Facultad de Ciencias (Universidad de la República), was used for more detailed studies. The analytical conditions were: 20 kV acceleration voltage, 20nA electron beam current and 5 µm spot. Back-Scattered Electron (BSE) images, EDS individual spot analysis and compositional maps were obtained for selected samples. Compositional maps were processed by superposition of different element signals (for example Ca-Mg, Na-Ca, Si-Al, Si-Mg etc) to evaluate the sample mineral distribution. The comparison of the spectra obtained through individual spot analysis with theoretical spectra confirms the metamorphic mineral assemblage. This last feature in conjunction with the observed microstructures allows defining metamorphic conditions within the greenschist facies**.** The lower metamorphic boundary is constrained by: (1) the tremolite first occurrence at 410ºC and 100MPa, (2) the grain boundary migration of calcite, starting at 400ºC and (3) the phogopite presence, which begins at 400-425ºC. The upper metamorphic boundary is constrained by: (1) the albite-oligoclase exchange, near to 500ºC, which was not reached, (2) the absence of clear evidences of quartz grain boundary migration, which starts to operate near 500ºC, and (3) the first tremolite occurrence in a sillimanite type metamorphic gradient, at 470ºC and 500MPa. The fluid composition cannot be determined, but the large albite crystals that were not completely transformed to Ep+Ms coexisting with hydrous minerals (Tr, Phl) suggest an intermediate xCO_2-H_2O fluid composition. In summary, due to rock-textures and minerals, the unit must experienced regional metamorphism, reaching greenschist facies, with 410-500ºC and 100-500MPa as metamorphic conditions boundaries, and probably intermediate xCO_2-H_2O fluids. Therefore we propose an Abukuma type gradient for the main orogenic metamorphism.

Keywords: METAMORPHISM, GREENSCHIST, MARBLES