

CATHODOLUMINESCENCE OF QUARTZ AND THE ORIGIN OF THE CAMBRIAN MESÓN GROUP, NW ARGENTINA

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RESUMEN

Estudiamos cuarzos detríticos de la Formación Puncoviscana de edad precámbrico a cámbrico inferior y del Grupo Mesón de edad cámbrico inferior a medio en el noroeste de Argentina. Se encuentran cuarzos de origen volcánico, plutónico y metamórfico en relaciones diferentes. Los datos indican que el Grupo Mesón no fue reciclado de la Formación Puncoviscana.

INTRODUCTION

In NW Argentina, the Lower to Middle Cambrian Mesón Group overlies the Ediacarian to Lower Cambrian Puncoviscana Formation with an angular unconformity. Therefore, the Puncoviscana Formation could be a possible source for the detritus of the Mesón Group with relatively short detrital transport necessary. To elucidate a possible recycling and to reveal the dominating source rock types of the sediments we analyzed the detrital quartz grains from sandstones and conglomerates from the two geological units. Because both units contain quartz-rich sedimentary rocks we measured cathodoluminescence (CL) color spectra of the detrital quartz grains (cf. Augustsson & Bahlburg, 2003, Fig. 2). Thereby we used the fact that quartz emits light during electron bombardment, the color of which depends on defects in the crystal lattice (e. g., Götze et al., 2001). As a result, quartz grains

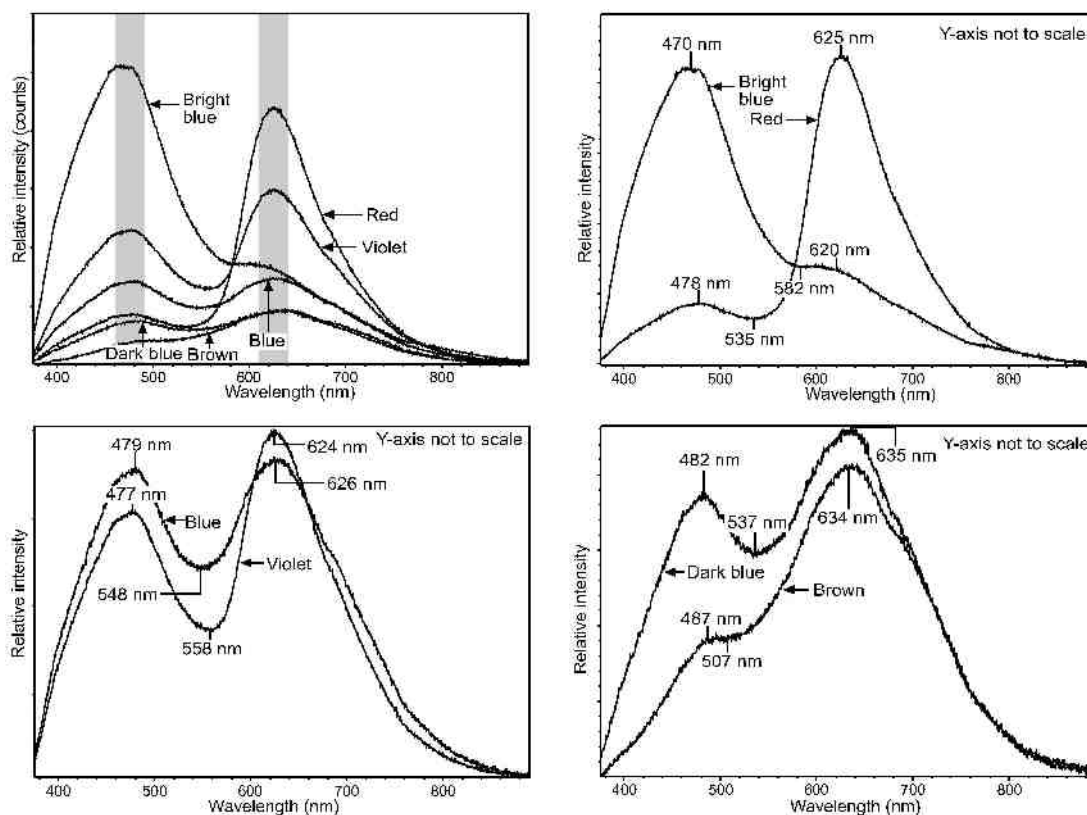


Fig. 1. Typical spectra for different CL colors of quartz. Gray fields = areas for the main peaks. Figure from Augustsson & Bahlburg (2003).

of different formation environments develop different CL colors. Red and violet luminescence indicates a volcanic origin, blue quartz grains likely are plutonic, and brown quartz is of regional metamorphic origin (Zinkernagel, 1978, Augustsson, unpubl. data).

RESULTS

Totally more than 300 detrital quartz grains of 17 samples were analyzed for their CL properties from the Puncoviscana Formation (ca. 80 grains) in both Quebrada de Humahuaca (Province of Jujuy) and Quebrada del Toro (ca. 24-25°S, 66°W; Province of Salta) as well as quartz grains from the Mesón Group (ca. 250 grains) in Quebrada de Humahuaca (ca. 23-24°S, 65°30'W; Fig. 2). The CL results of quartz from the Puncoviscana Formation reveal typical wavelength spectra for red and violet luminescing quartz, as well as blue and brown quartz grains in proportions of ca. 35 % (red and violet taken together), 45 % and 20 %, respectively. In the Mesón Group, blue, red and violet luminescing quartz grains dominate, pointing to volcanic and plutonic sources. The proportion of grains of possible volcanic origin is ca. 40 % in the sandstones of the Mesón Group in the Quebrada de Humahuaca at Garganta del Diablo east of the village of Tilcara and ca. 20 % in the sandstones at Angosto de Perchel further north. The sand- and granule-sized quartz grains in the analyzed conglomerates generally are more enriched in red and violet luminescing quartz grains than the sandstones. The plausible volcanic quartz grains have a very weak negative trend up-section in Angosto de Perchel from ca. 20 % in the oldest beds to ca. 15 % in the uppermost part of the outcrop. Brown (metamorphic) luminescing grains are rare (when present, ca. 2 %).

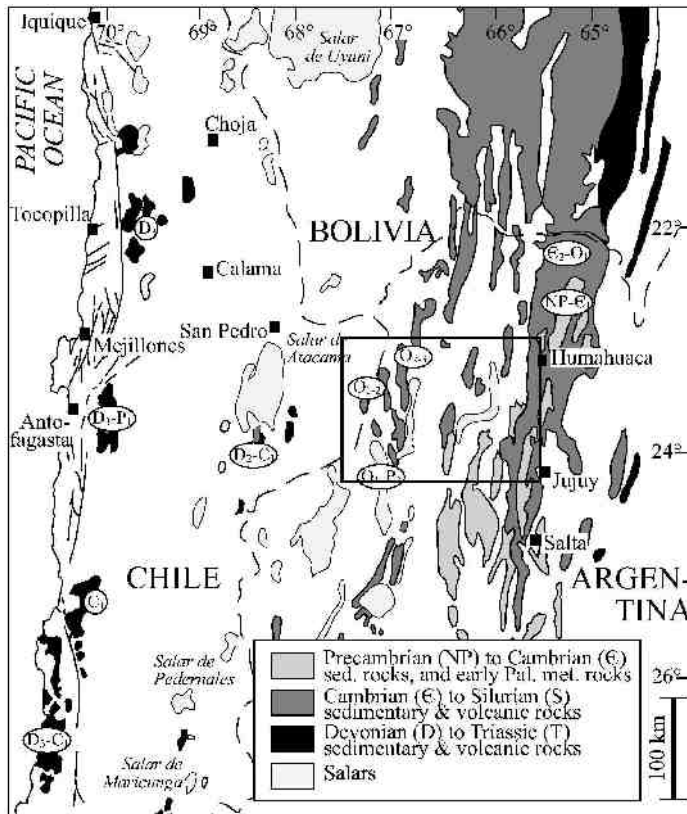


Fig. 2. NW Argentina, N Chile and S Bolivia with Quebrada del Toro and Quebrada de Humahuaca in the right part of the marked square. Map modified from Bahlburg & Hervé (1997).

CONCLUSIONS

Most analyzed quartz grains of the Puncoviscana Formation contain Fe^{3+} , as revealed by a CL emission band at ca. 700 nm. The wavelength spectra of the quartz grains of the Mesón Group have not been affected by Fe^{3+} incorporation in the crystal lattice, however. This points to the absence of

recycled quartz grains of the Puncoviscana Formation in the Mesón Group. This is also indicated by the large difference in metamorphic quartz grain content. The absence of recycling from the Puncoviscana Formation into the Mesón Group implies that the detrital quartz of volcanic origin derived from exposed magmatic rocks in the source areas - at least during deposition of the Mesón Group. Hence, the large input of volcanic quartz grains into the Mesón Group may imply regional source areas dominated by volcanic rocks in Early to Middle Cambrian time.

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