The Origin of Crack-seal - Textured Quartz in Auriferous Quartz Veins of the Meguma Group, Nova Scotia: a Combined Hydraulic Fracture - Replacement Model[1]

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Crack-seal (cs) or ribbon-textured quartz, common in mesothermal quartz veins hosted by slate-belt sequences, are characterized by numerous parallel bands/laminae of mainly silicate minerals. In the Meguma Group deposits, southern Nova Scotia, such veins have been the focus of gold mining for over a century, hence, numerous suggestions have been advanced for their origin (e.g., exhalative, organic mounds, cs inclusion bands, water sills). A new model for cs quartz is presented based on detailed macro- and micro-scale analysis of the veins hosted by greenschist facies metaturbiditic rocks of the Meguma Group. Critical to our interpretation is that cs quartz occurs in discordant veins as well as in the dominant bedding-concordant veins and that the veins containing cs quartz are composite (i.e., contain two distinct quartz types). In addition, the following features are inconsistent with previous interpretations of vein formation where cs-textured quartz occurs: (1) it constitutes variable proportions (0-90%) of veins, (2) a lack of lateral ($\leq$10-20 cm) and vertical ($\leq$50-60 cm) continuity, (3) oblique rather than parallel alignment of the cs texture with vein-wallrock (v-wr) contacts common, (4) when connected, the cs domains extend the width of vein, (5) cross-sectional shapes perpendicular and parallel to v-wr contacts are 5-7 sided polygons (interfacial angles 44-85°) and elongate trapezoids [aspect ratios (H:W) of 2:1 to 20:1], respectively, (6) optical continuity is preserved across the abrupt interface separating cs and homogeneous milky quartz, (7) mineral inclusion bands are 0.01-1 mm thick, thus 10^4-10^5 bands occur in some cs-textured quartz, (8) fluid inclusions in milky quartz proximal to cs quartz contain abundant solid phases vs. simple L-V types more distal, (9) overgrowths of milky quartz about polygonal-shaped cs domains terminate at triple junctions, and (10) EMPA analysis indicates laminae consist of qtz-bt-ms-Fe/Mg chl-Fe chl-alb-Kf (Or_{95-100})-apt-tour, of which some minerals are absent in quartz veins. The following model is proposed for the composite veins: an initial phase of bedding-parallel dilatancy producing polygonal columns of wallrock material with subsequent infilling of void space during opening and concomitant silicification of wallrock columns to generate cs-textured quartz.

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