Ca-METASOMATISM IN CRYSTALLINE TARGET ROCKS FROM THE CHARLEVOIX STRUCTURE, QUEBEC, CANADA: EVIDENCE FOR IMPACT-RELATED HYDROTHERMAL ACTIVITY. Claudia A. Trepmann[1], Thomas Götte[2] and John G. Spray[1], [1] Planetary and Space Science Centre, Department of Geology, University of New Brunswick, 2 Bailey Drive, Fredericton, New Brunswick, E3B 5A3, Canada, trepmann@unb.ca, [2] Institut für Geologie, Mineralogie und Geophysik, Ruhr-Universität Bochum, D-44780 Bochum, Germany.

Post-impact fluid flow can be an important process in many impact craters. It can result in economic mineralisation [1] and may facilitate favourable conditions for life on Earth [2] and other planets [3]. A fluid-rock circulation system can be generated due to a reaction of the products of impact-induced dehydration, degassing and melting of target rocks with superficial, meteoric and/or ground water [*e.g.*, 1, 2].

In this study, the mineralogy and the microfabric of Ca-rich zones (Fig. 1), comprising mainly prehnite, quartz and calcite, in crystalline target rocks from the 54 km-diameter Charlevoix impact structure have been investigated by optical microscopy, analytical scanning electron microscopy and cathodoluminescence microscopy. The results reveal a Ca-metasomatic event caused by the reaction of a hot fluid (250-380°C) with host gneisses. Secondary prehnite, quartz and calcite crystallised and partly replaced feldspar, pyroxene and quartz of the charnockitic host gneisses (Fig. 2). The components that have been introduced by the fluid into the charnockitic gneisses are mainly CaO, H_2O and CO_2. The components SiO_2, Al_2O_3 and Fe_2O_3 which were also in solution, were probably mainly inherited from the host gneiss. Open, as well as filled, vesicles occur exclusively in the Ca-metasomatic modified zones. This indicates the release of volatiles by boiling or decompression, as well as successive precipitation. Comminution of the host gneiss at the contact with the Ca-rich zones and cataclastic deformation of remnant clasts within the Ca-rich zone are proposed to be due to a sudden and violent injection of the fluid. The composition, the microstructures, as well as the high temperatures of the fluid and the restriction of the Ca-rich zones to the impact structure, indicate that the metasomatism is impact-related. The fluid is proposed to have been released and mobilised due to a reaction of the products of impact-induced degassing and/or melting of carbonaceous Ordovician target rocks with surface and/or ground water. The fluid was injected into the underlying shock-fractured and shock-heated basement. A short lived but widespread post-shock hydrothermal activity can explain both the scarcity of the Ca-rich zones in most localities and their general occurrence in the Charlevoix structure.

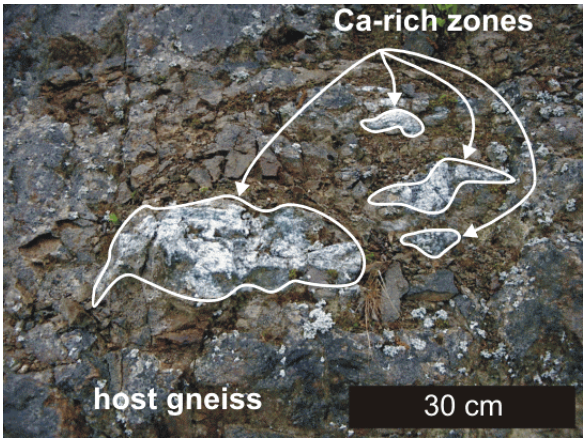

Fig. 1. Field photograph of Ca-rich zones in charnockitic host gneiss, containing open vesicles.

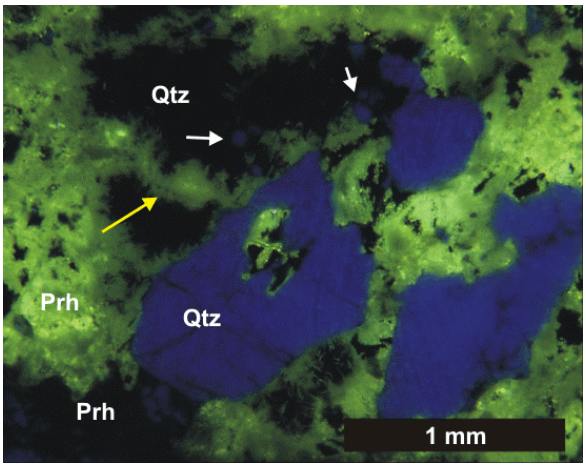

Fig. 2. CL-photomicrograph showing blue luminescent shocked quartz crystals inherited from the host gneiss in Ca-rich zone. Secondary quartz aggregate shows dark luminescence, prehnite shows a yellow or a dark luminescence. Note globular single remnant shocked, blue luminescent quartz in newly formed quartz aggregate (white arrows) and prehnite healed fracture in quartz aggregate (yellow arrow).

References: [1] Naumov, M.V. (2002) In: Impacts in Precambrian shields (C. Koeberl, ed.). Springer, Berlin (117-171). [2] Osinski, G.R., Spray, J.G. & Lee, P. (2001) Meorit. Planet. Sci. 36, 731-745. [3] Rathbun, J.A. & Squyres, S.W. (2002) Icarus 175, 362-372.