MONOCLINIC AND TETRAGONCAL PLAGIOCLASE (An54) IN SHOCK VEINS FROM THE CENTRAL UPLIFT OF THE MANICOUAGAN IMPACT STRUCTURE

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Introduction: Shock veins, typically <2 mm wide, occur sporadically in groups that pervade the ~20 km diameter meta-anorthositic central uplift at Manicouagan (crater rim diameter ~85 km). Previous studies have identified stishovite in these veins [1]. This work documents the discovery of additional high-pressure polymorphs: monoclinic- and tetragonal-structured plagioclase. Critically, the high-pressure polymorphs possess the same composition as the non-shocked triclinic phase (An_{54}).

Properties: Raman spectrometry and electron-backscattered detector (EBSD) analysis indicate that the monoclinic plagioclase possesses a pseudo-monoclinic jadeitic structure (space group C2/c). It commonly occurs with a granular habit at grain sizes of 1-5 μm. The unit cell dimensions are a = 9.45 Å, b = 8.59 Å, c = 5.23 Å; $\alpha = \gamma = 90.0°$, $\beta = 107.6°$. The tetragonal plagioclase typically occurs as needles (1 – 4 μm long). It possesses a hollandite-type structure (space group I4/m), with unit cell dimensions a = 9.31 Å, b = 9.31 Å, c = 2.72 Å; $\alpha = \beta = \gamma = 90.0°$. Tetra-plagioclase is commonly found in association with stishovite. Both the mono- and tetra-plagioclase forms are set within an amorphous (glassy) matrix.

Development: The mono-labradorite appears to have been derived via solid-state transformation from triclinic labradorite during, or following, communition and local melting of plagioclase within the shock vein. Its development is puzzling because the C bar 1 to C2/m transformation occurs at increasing temperature the higher the Ca content of the plagioclase. At An_{54}, the melting point is intersected before the monoclinic structural state is encountered – at least under normal circumstances. We therefore assume that at high pressures the transition temperature is depressed, or that melting is inhibited. The tetra-labradorite occurs only as neo-crystals between mono-labradorite, which indicates that it crystallized from a melt. The presentation will focus on the development of high-pressure polymorphs of plagioclase, starting with a normal triclinic labradorite located away from the shock veins. As the veins are approached the laboradorite increasingly develops planar deformation features. In addition to the occurrence of mono- and tetra-labradorite within the shock veins, amorphous material of labradoritic composition and maskelynite can be developed. These occurrences provide exciting new constraints on the shock conditions and timing of plagioclase polymorph formation, as well as the P-T-t complexity of shock veins.

References: [1] Biren M. B. and Spray J. G. 2011. *Earth and Planetary Science Letters* 303:310-322.