POPIGAI IMPACT FLUIDIZITES DERIVED FROM THE "WET" UNITS OF TARGET: INJECTIONS OF HOT & MOBILE MELT+H_2O MIXTURES WITH LONG-LIVING RESUDUAL SHOCK PRESSURES. S. A. Vishnevsky[1], J. Raitala[2], [1]Inst. of Geology & Mineralogy, 3 Koptug pr., Novosibirsk-90, 630090, RUSSIA <svish@uiggm.nsc.ru>; [2]University of Oulu, Oulu, P.O. Box 3000, FI-90014, FINLAND, <jouko.raitala@oulu.fi>.

Introduction: "Dry" model is common in various impact studies. However, such an approach is an incomplete and very simplified scheme, because the presence of H_2O principally changes all the impact processes, from the shock melting [1], origin of high-pressure polymorphs [2], excavation [3], etc., to post-shock evolution of impact melts [4] and alteration. Below, there are some specific features of impact processes, provided by H_2O, and considered on the example of Popigai impact fluidizites (PIFs).

Description: PIFs (see for details in [5-8]) form dykes and veins in low-shocked host gneiss (HG) lumps from the megabreccia. Macroscopically, they look like as psammitic tuffs with impact glass particles. Fluidal schlieren, "welded" with other parts of the rock, dominate among the particles. "Swirled" and stream-like particles are often present, indicating turbulent mixing of the material during injection **(Fig. 1).**

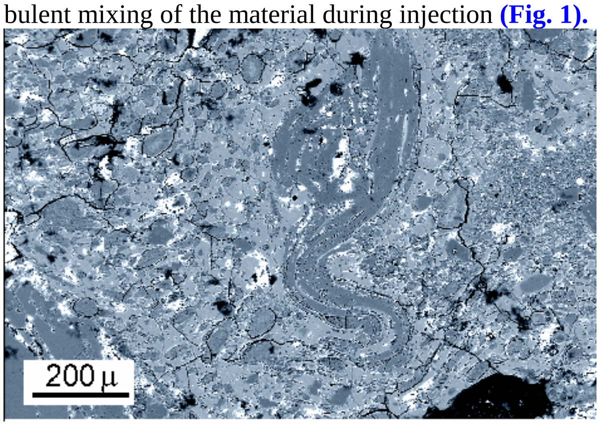

Fig. 1. Heterogeneous glass schlieren from PIFs, made up of convoluted homogeneous (light-gray) and K-Na-Ca feldspar (dark-grey) glasses. SEM image.

Much of the glasses are mixed homogeneous ones derived from the target gneisses; however, some of glasses are rather heterogeneous **(Fig. 1),** or made up of pure monomineral (SiO_2 and K-Na-feldspar compositions) species. Gas chromatographic and ion probe data show [6] that PIF glasses contain essential amount of H_2O (from 1.1 wt. % in lechatelierite up to 9 wt. % in K-Na feldspar glasses). A great number of co-genetic fluid inclusions of various densities are present in lechatelierite schlieren (LSs) **(Fig. 2).** Following to cryometry and thermometry [5,9], the fluid phase of the inclusions is made up of H_2O with low salinity (from 0.5 to 8 wt. % of salts in NaCl-equivalent).

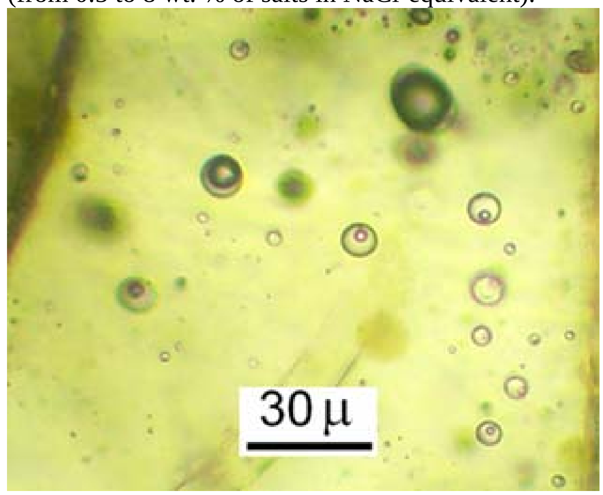

Fig. 2. Co-genetic water fluid inclusions of various densities in lechatelierite schlieren from PIFs (at 20°C). Micro photo in plane polarized light.

In some cases the rock glasses contain co-genetic immiscible calcite globules (CGs) and montmorillonite globules (MGs) **(Fig. 3)** [5,8]. MGs in LSs are of a special interest **(Fig. 4).** They are of Ca-type, rich in Fe and Mg and low in Na (average of 12 analyses of individual MGs, in wt. %: SiO_2 50.43; TiO_2 0.36; Al_2O_3 13.52; FeO 12.85; MnO 0.03; MgO 5.92; CaO 1.49; Na_2O 0.07; K_2O 0.42; BaO 0.08; total 85.17).

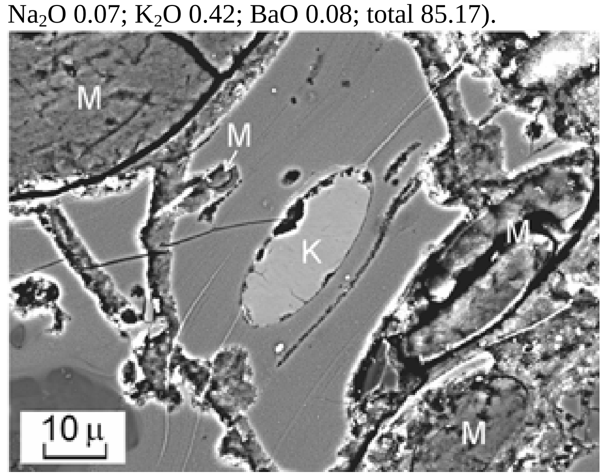

Fig. 3. Co-genetic globules of calcite (K) and montmorillonite (M) in mixed PIF glass. SEM image.

Interpretation: Heterogeneity of PIF glasses indicates their origin from the marginal part of the Popigai impact melting zone (P~50-60 GPa, R ~14-15 km). Large

Fig. 4. Co-genetic MGs (indicated by arrows) together with water fluid inclusions in LS from PIFs (at 20^{o}C). Micro photo in plane polarized light.

amount of H_2O and data on REE and trace elements show [10,11] that the glasses were derived not from the "dry" granulites, but from the "wet" Archean diaphtorites. The HGs with PIF dykes and veins, exhibit no petrographic traces of shock affect and were derived from principally another zone of shock metamorphism (P<8-10 GPa, R>25-30 km). So, the melt+H_2O mixtures were able to travel up to ~12-15 km distance from their birthplace to the point of dynamic contact with the HG during the excavation **(Fig. 5).** The simplest estimations based upon impact cratering theory show that the time of such a travel was ~10-12 s [7].

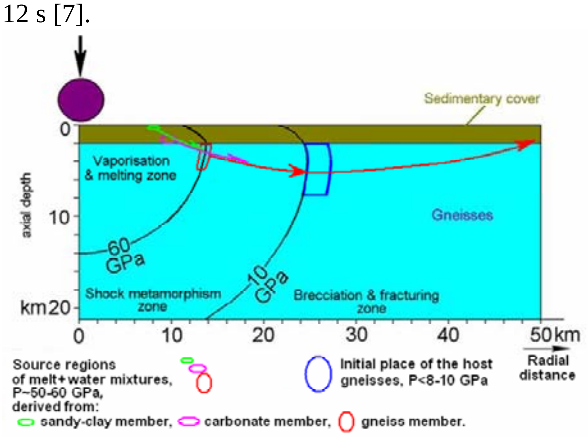

Fig. 5. Principal spatial sources and excavation transport of PIF material from the birthplace to the point of dynamic contact with the HGs.

LSs in PIFs show that the mixtures were hot, >1700^{o}C, during the injection. Dense (0.5-1 g/cm^3) H_2O inclusions in LSs are of particular petrologic concern, indicating their high, ~0.8 to 3.3. GPa, trapping pressures. Such pressures could not be lithostatic ones. So, the mixtures preserved the residual shock pressures during the time of ~10-12 s until the contact with the HGs. These pressures are explained by buffer action of H_2O [9]. The conclusion meets an agreement with the experimental data by [3], namely: since any moment, the pressure release of "wet" compressed materials is controlled by H_2O behavior. CGs disseminated in PIF glasses, are the result of shock melting of Cambrian carbonate members of the target [5,8]. MGs most probably were derived from shock-molten maturated Paleozoic and Mesozoic members of sedimentary cover [8]. Spatially-different sources of CGs, MGs and gneiss-derived PIF glasses are the evidence of very mobile state for melt+H_2O mixtures during the Popigai impact event. The contact interaction of the products was a result of turbulent centrifugal excavation flow. MGs from LSs and other PIF glasses, are rather similar to the montmorillonites known in the Ries [12] and can serve as a good supporting argument for the hypothesis by [1,3,12,13] about the origin of supercritical H_2O+silicate fluids and hydrous silicate melts with the unlimited solubility, derived from some "wet" target lithologies as a result of shock metamorphism.

Conclusion: Hydrous and very mobile impact melt mixtures were derived from various "wet" target units (Archean diaphtorites, Cambrian carbonate and Paleozoic+Mesozoic sandy-clay(?) rocks) during the Popigai impact event. Due to the action of H_2O buffer the mixtures could keep relatively high (up to 3.3 GPa) residual shock pressures for a long (up to 10-12 s) time. The data may be of comparative interest for study of both the terrestrial and other planet (Mars, etc.) astroblemes originated on the water-bearing targets.

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