TEKTITES, EXPERIMENTAL EQUIVALENTS AND PROPERTIES OF SUPERHEATED (IMPACT) MELTS. P. Jakeš(1,2), S. Sen(1),and K. Matsuishi(3) 1.Department of Geosciences, University of Houston, Houston TX, 77204 2.Lunar and Planetary Institute, 3303 NASA Rd.1, Houston TX, 77058 3.TCSUH, University of Houston, Houston Tx., 77204.

The formation and fractionation of early planetary crusts, including the formation of atmosphere and hydrosphere, relate to the behaviour (melting, vaporization) of both impactor (planetesimal) and target (planet),e.g.[1]. Impact melts could have experienced temperatures high above the liquidus and hence may have different physical properties (viscosity and volatility).

Siliceous melts on terrestrial impact sites and tektite glasses show signs of higher-than-liquidus temperatures in their "geological" behavior. In spite of their extremely high viscosities (in near-liquidus temperatures),and the present lack of volatile phases (which could be responsible for the lowering the viscosities), the glasses (tektites) show remarkable homogeneity of compositions[2].

In order to understand "frozen-in" high-temperature properties of impact melts we have studied (a) Raman spectra of naturally occuring, compositionally similar, highly siliceous, impact-related glasses (Wabar crater, Darwin glass, Ries crater glass, Aouelloul crater glass, Libyan desert glass, Zamanshin and Kara glasses) and tektite glasses (moldavite, indochinite, bediasite, and Muong type indochinite) and also (b) Raman spectra of natural glasses (indochinite) melted high above liquidus and quenched to room temperatures.

(a) There are general similarities in Raman spectra of natural glasses, tektite glasses, and those of vitreous silica in the low frequency region, with peaks around 430, 490, 605, and 800 cm-1, though shifted due to compositional effects [3]. Theoretical calculations indicate that studied glasses should have 3-D tetrahedral network structure (NBO/T = 0.0 - 0.09).

The spectra of these glasses are very similar to vitreous SiO_2 in the low frequency region (less than 800 cm-1). In the high frequency region spectra are different and have been deconvoluted using Mysen's technique. All glasses are fully polymerized showing presence of 4 bands (except Ries and Wabar) in the high frequency region. Of these, bands characteristic of pure Si-O symmetric strech vibration are at 1030 - 1060 cm-1 and 1150 - 1200 cm-1 whereas modes at 950 - 970 cm-1 and 1120 - 1130 cm-1 are due to symmetric strech vibration of silicate tetrahedra with 2 and 1 oxygen bound to Al [=Si(OAl)2 and Si(OAL)]. Ries and Wabar crater glasses show very compressed high frequency region (900 - 1000/ 1150 cm-1) which shows presence of two strong bands at 970 - 980 cm-1 and 1060 - 1070 cm-1. Other two bands are probably weak and remain unresolved.

(b) Glasses quenched (indochinite as a starting material) from temperatures 350 degrees above the liquidus temperature show different Raman spectra (and consequently different structures) than those quenched from near liquidus conditions. Interestingly enough, most of the tektite glasses, as well as natural glasses from impact sites, are similar to the "near-liquidus" Raman spectra. This may indicate that cooling of natural glasses (tektites) if it took place from above liquidus temperatures was different from quenching in laboratory conditions. With the exception of Ries glass, all other glasses appear to have little "high-temperature" memory.

REFERENCES: [1] Gazis,C.A., Ahrens,T., LPSC XXI, 407 -408. [2]Koeberl,C., Ann.Rev.Earth.Planet.Sci., 14, 323-350. [3]Mysen,B., Am.Min., 75, 120 - 134.