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Tissint is a Rosetta stone deciphering Noachian magmatic activities and dynamic events in Mars young history

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Tissint is a new witnessed Martian meteorite. NWA 6162 is a new Martian meteorite find. Both are Al-poor ferroan basalts and classified as shocked phyric and depleted shergottites. An array of numerous thin shock-melt veins and few thick shock-melt veins pervasively intersect Tissint each containing high-pressure assemblage. Shock features in Tissint could tentatively be assigned to three dynamic episodes on Mars with distinct textural settings, abundance and compositions of the high-pressure inventories;

The first dynamic event induced total melting of feldspar and its quenching at high-pressure to maskelynite glass along with liquidus jadeite, latter confirmed by the characteristic Raman analysis. Pervasive melting of pyroxene, pyrrhotite and titanomagnetite also took place at this episode as deduced from the spatial relationships. Acicular jadeite crystals grew on the pyroxene surface into the maskelynite liquid at high-pressure. Textural and spatial relationship of the maskelynite pools and the bordering jadeite suggests that jadeite was quenched from the plagioclase melt at P: 10˜19 GPa and T: 2000 degree. This dynamic event entirely destroyed the original igneous texture and reset the radiometric age at the impact-melting episode.

An array of thin shock-melt veins fan through the whole Tissint. They penetrate Tissint along pyroxene grain boundaries and cut through the jaedite bands. An assemblage of idiomorphic liquidus high-pressure majorite-pyropess and magnesiowutite fill these shock melt veins.

Another type of shock-melt veins that cross cuts pyroxene contains considerably crushed, fragmented and mobilized majorite-pyropess + magnesiowustite grains. Fragmentation and mobilization could have probably taken place in a later dynamic or more likely a Martian tectonic event subsequent to the first vein formation episode.

Fayalite-rich rims of the originally zoned olivine partly inverted to polycrystalline ringwoodite either in coarse ringwoodite domains in the originally fayalite-rich rims or in polycrystalline aggregate in the original olivine suggesting formation by incoherent olivine-ringwoodite phase transition. The Raman spectrum also shows several original olivine crystals adjacent to shock-melt veins were shock dissociated to a fine-grained assemblage of $MgSiO_3$ perovskite + magnesiowustite. Some olivine grains entrained in the thick shock-melt veins of NWA 6162 depict dissociation textures to $MgSiO_3$ perovskite + magnesiowustite. This strongly suggests that the olivine dissociation took place at equilibrium peak-shock pressure slightly overstepping 25 GPa and at T above 700 degree. The three deciphered dynamic events on Tissin, and NWA 6162 lithologies entirely erased their igneous integrities.

Tissint and NWA 6162 share many of the encountered pervasive shock-melting effects and high-pressure phase transformations with other phyric and basaltic shergottites, unfortunately not recognized by numerous Mars scholars advocating for several volcanic eruptions younger than 575 Ma that is discrepant with the dynamic induced effects documented by us. We cast considerable doubt on the radiometric ages shorter than 575 Ma reported in the past 39 years to be the igneous crystallization ages, especially when considering their coincidence with a well-established late dynamic event. These short ages resulted from partial or total shock-induced age resetting.