D/H AND WATER SOURCES IN TISSINT.

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Introduction: The shock history of Tissint has been widely studied, with reports of various shock effects in the primary igneous minerals, as well as high pressure polymorphs of these minerals and shock-induced melt pockets/veins[1-5]. The aim of this study was to measure the hydrogen isotope ratio and water content of a number of Tissint phases that have experienced differing apparent shock pressures, in order to determine how hydrogen is affected by shock in martian meteorites. As current estimates of the water content of Mars' interior are based on the water content of martian meteorites, it is vital to know whether impact-related shock can significantly change the amount of water in these samples before they reach Earth.

Results: Hydrogen data, obtained using the ims 1280 ion microprobe at the University of Hawai'i, indicates the water content of Tissint olivine and pyroxene is variable (722-3551 ppm H_2O), but generally high relative to terrestrial standards. Thus, despite their nominally anhydrous nature, a reliable D/H ratio can be obtained from these minerals. The D/H ratio in Tissint olivine and pyroxene varies between δD +100 and -150 ‰ (2σ ±46-67 ‰), a range similar to terrestrial upper mantle minerals[6]. Primary olivine-bound melt inclusions contained the highest water contents of all phases measured in Tissint (4888-5629 ppm H_2O), again with low D/H ratios (δD -98 to 372 ‰) relative to the martian atmosphere (δD ~+4200 ‰[7]). Some areas of shock-produced melt contain D/H ratios similar to martian atmospheric values (+4224 per mil), but other areas have much lower values (-66 per mil). The water content of this melt is low (157-2317 ppm H_2O), and there is no correlation between water content and D/H ratio.

Disscussion: The high water content of primary igneous phases such as pyroxene, olivine, and olivine-bound melt inclusions, coupled with the low D/H ratios of these phases, suggests the basaltic melt that formed Tissint was rich in martian magmatic water[8-9]. During the production of shock melt, hydrogen appears to have been degassed, resulting in variably low water contents (the variation probably relates to the water content of the primary phases that were included in melt production). Variable D/H ratios in the shocked melt is less easily explained, especially as the ratio can vary by >1000 ‰ within <100 μm in the same pocket. Transmission electron microscope analyses are underway at the University of Glasgow to investigate this variation.

References: [**1**] Baziotis et al., 2013. *Nature Communications* 4:1404. [**2**] Hu et al., 2013. Abstract #1041, *44th Lunar and Planetary Science Conference.* [**3**] Summerson et al., 2013. Abstract #1974, *44th Lunar and Planetary Science Conference.* [**4**] Walton et al., 2013. Abstract #1039, *44th Lunar and Planetary Science Conference.* [**5**] Sharp et al., 2014. Abstract #2820, *45th Lunar and Planetary Science Conference* [**6**] Shaw et al. 2012. *Nature Geoscience* 5:224-228. [**7**] Bjoraker et al., 1989. *Bulletin of the American Astronomical Society* 21:991. [**8**] Gillet et al., 2002. *Earth and Planetary Science Letters* 203:431-444. [**9**] Hallis et al., 2012. *Earth and Planetary Science Letters* 359–360:84–92.