LIQUIDUS HIGH-PRESSURE ASSEMBLAGES IN SHOCKED MARTIAN SHERGOTTITES: CONSTRAINTS TO EQUILIBRIUM PEAK SHOCK-PRESSURES AND CONSEQUENCES TO RADIOMETRIC AGES

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Introduction: The shergottites NWA480, NWA856, NWA1068, Los Angeles, SAU05, Shergotty, Zagami and ALH77005 were investigated to characterize shock-induced effects, the high-pressure assemblages and to use them in conjunction with results of robust laboratory static experiments along the join $CaAl_4Si_2O_{11}$-$NaAl_3Si_3O_{11}$ [1] for reliable estimates of the equilibrium peak-shock pressures. Special interest was devoted to the settings of the liquidus assemblage stishovite + Na-CAS ($CaAl_4Si_2O_{11}$-$NaAl_3Si_3O_{11}$ [1]) and the nature of the coexisting maskelynite. The assemblage was encountered in all studied seven shergottites except in ALH77005. ALH77005 is barren of high-pressure minerals. It depicts clear evidence for pervasive melting of plagioclase, partial melting and quenching of olivine and pyroxene (CPX) to vesicular mineral glasses at ambient pressure. Here, we also report the novel finding of the liquidus high-pressure pair Na-CAS + stishovite and establish the nature of maskelynite in the 7 shergottites, accordingly profoundly recalibrate their peak shock pressures, discard former ones and discuss the consequences to the previously reported radiometric "*ages*".

Results: Contrary to previous reports [2-7] we encountered unambiguous evidence for melting of plagioclase to maskelynite liquid and it's quenching at high-pressure to glass. The evidence is multifold: (1) High abundance of meandering mineral schlieren in every individual maskelynite grain, (2) Fragmentation of CPX near the maskelynite interface, their whirl drift into maskelynite and their partial melting to streaky schlieren in maskelynite, thus unequivocally refuting claims that maskelynite is diaplectic glass [2-7]. These features are optically irresolvable in transmitted light microscopy and could only be discerned either in reflected or BSE-SEM microscopy. The liquidus pair Na-CAS + stishovite crystallized in the first 7 shergottites from silicate liquid pools that functioned as perfect pressure transmitting media. Hence, it reflects an equilibrium peak-shock pressure of $P \leq 22$ GPa at $T > 1{,}900 < T < 2{,}200$° C [1] thus refuting unrealistic mechanisms proposed by [2-7] and of P-T spikes at $P > 70$-80 GPa by [4-7].

Conclusions: Our results reveal novel far-reaching consequences: (1) the first seven shergottites were shock-melted probably at the same event, (2) they probably originated from the same high-pressure regime of the impact site on Mars, (3) many "*ages*" reported for shergottites [8] are merely shock-ages, (4) any attempt to date shocked shergottites without careful petrographic investigations can only lead to ambiguous results [8, 7].

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