# AMORPHOUS COMPONENT OF MARTIAN SOILS AND SEDIMENTARY ROCKS: WHAT FRACTION IMPACT GLASSES?

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**Introduction and Background:** Recent measurements by the MSL CheMin XRD instrument have suggested that a large (27% ± 14%) fraction of the Martian soil is composed of X-ray amorphous materials [1]. In conference discussions; odd minerals have been suggested to be the 'culprit' for this large percentage; the large range of impact glasses, from maskelynite through complete impact melts, created from impact events has not been considered. Further, the alteration of impact glasses may yield more amorphous materials. On a related note, several works that deconvolve remote TIR data for mineral abundances have suggested a ~10-15% "glass or amorphous phase" [all of 2] to exist over most of Mars on rover and orbital scales.

**What is impact glass?** Using a classification scheme for basalt [3], impact glass is defined as these glasses produced from impact: solid state transformation of plagioclase feldspar to diaplectic maskelynite in Class 2 shocked basalt to flowing plagioclase glass (Class 3) to vesiculated plagioclase glass (Class 4) to complete impact melts (Class 5) when augites are melted with the plagioclase. A collection of impact glasses from Lonar Crater, India are analyzed [4, abstract #5117] with petrography and XRD to unravel their pre-impact alteration from the alteration of impact glasses, with the expectation that the results listed here can provide clues to determine the amorphous component of Mars

**Methodology:** We calculate "amorphous" as 100 – "crystallinity" reported from XRD results [4]. Because alteration is also of interest for Mars, we list *crystalline* alteration products.

| sample | description | amorphous% | alteration: |
|---|---|---|---|
| LC05-056 | unshocked | 7 | "none" |
| LC09-345 | Class 2 | 50 | "none" |
| LC09-284 | Class 2 | 50 | "none" |
| LC09-235 | Class 2 | 50 | smectite, quartz, albite |
| LC06-135 | impact melt | ~95-99 | smectite, calcite |

**Discussion:** Though secondary alteration minerals were listed in the database, only primary igneous minerals were reported by the analyses of XRD data of the first three listed on the chart. Their abundances (*e.g.*, ~75% kanoite CPX, ~20% pigeonite in LC09-284) are correct given that only 50% of the sample is crystalline. Likely, any alteration minerals in the first three samples were not contained within the database. The 50% amorphous component of the Class 2 shocked basalts can be attributed to the conversion of crystalline labradorite to amorphous maskelynite. We expect this trend to continue in Rietveld Refinement calculations for Classes 3 and 4 [4]. Nearly 100% of all minerals are melted to an amorphous melt in Class 5 shocked basalts, save for some oxides and relict augites [3].

**References:** [1] Morris et al. (2014) *LPSC*, #1319 [2] Glotch & Bandfield (2005) *JGR*; Ruff et al. (2006) *JGR*; Rogers & Aharonson (2008) *JGR* [3] Kieffer et al. (1976) *LPSC*, 1391-1412 [4] Wright (2014) *MetSoc*, #5117; http://www.hou.usra.edu/meetings/metsoc2014/pdf/5117.pdf