DECOMPRESSION CRACKS IN ALTERED BASALT UNDER SOLID-STATE SHOCK PRESSURES: A NEW MACROSCOPIC SHOCK TEXTURE S.P. Wright, Department of Geology and Geography, Auburn University, Auburn, AL, shawn.wright@auburn.edu

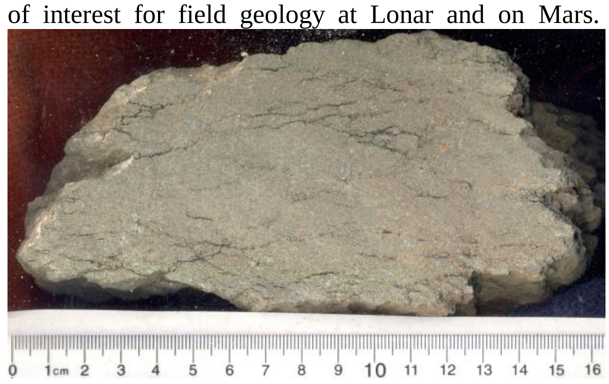
Summary: Solid-state transformation of labradorite plagioclase feldspar to maskelynite occurs at a specific range of shock pressure [1] referred to as "Class 2" [2] for shocked basalt. A new texture labeled as "decompression cracks" (see scans of cut sides below) forms where the protolith prior to shock was an altered basalt, which likely indicates the importance of volatiles while not melting. At higher shock pressures, glass is formed and it flows, which does not permit decompression cracks. Although only a small range of shocked basalt allows for decompression cracks to form, this can be used as a macroscopic texture in the field to locate shocked basalt and the impact melt-bearing breccia unit. Currently, shatter cones, at lower pressures, are the only macroscopic indicator of shock metamorphism.

Introduction: With three processes analogous to Mars (basaltic volcanism, aqueous alteration, and shock), Lonar Crater shocked basalts are excellent analogs for analyzing results from instrumentation sent to Mars. ~80 kg of "intermediately" (20-80 GPa) shocked basalt, which exist as clasts in the uppermost, impact-melt-bearing breccia (formerly, "suevite" [3]) layer at Lonar Crater, India [2], along with float that were former breccia clasts, were collected during a 2-month field season. These add to a large collection [4] of unshocked basalts and impact melts/glasses (aka Class 5 [1,2]). Petrographic and electron microprobe images reveal of range of shock pressures (deduced by phases and mineralogies of labradorite and augite); various protoliths such as fresh Deccan basalt, altered basalt (altered before shock) showing hematite, calcite, silica veins/pockets, and clays [4]; and what is interpreted as a consolidated soil or a sample from weathering horizons in-between individual basalt flows [4].

Decompression Cracks: Whereas thinly-bedded sedimentary rocks have layers or beds, and regional metamorphic rocks are foliated due to directed stress over long periods of time, typical Deccan basalt shows no such bedding or foliation. However, a subset (~25) of the collection of intermediately-shocked basalt have quasi-parallel "cracks" ~1 cm apart throughout the sample (Figures 1 & 2). These features are apparent in natural samples found in the Lonar ejecta both in-situ and as float, and cut sides display the feature. Petrography of these 25 samples showed all of them to be Class 2 shocked basalt [2], with solid-state maskelynite and no melted plagioclase glass ("Classes 3 to 4") [2], which provides constraints on the approximate shock pressure.

Interpreted Formation: For microseconds, the altered Deccan basalt was held under a shock pressure to compress labradorite into maskelynite; augites are fractured at this pressure. The lack of flowing or vesiculated glass, along with no decompression cracks found in Class 1/3/4/5 shocked basalts, suggest that these features form when the sample decompresses after being held at Class 2 shock pressures. At higher shock pressures, when plagioclase melts to a *flowing* glass, the near-instantaneous change in volume results in the glass flowing to account for the slight change in volume from ambient to compression to decompression. In Class 2 basalts, with no melted, flowing glass, the sample "cracks" to account for decompression, and hence "decompression cracks" are formed. These are only a feature of Class 2 shocked basalts with altered protoliths, and thus volatiles likely play a role. Fresh basalts subject to Class 2 pressures do not contain decompression cracks.

Implications for field geology: Decompression cracks are not a feature of all shocked basalts and are limited to a small subset: Class 2 solid-state shock pressures of altered protoliths. However, this feature is beneficial to locating such samples and thus identifying 1.) outcrops of impact melt-bearing breccia that may be 2.) altered basalts ejected from depth. Both of these are of interest for field geology at Lonar and on Mars.



References: [1] Stöffler & Hornemann (1972) *MaPS, 7*, 371-394 [2] Kieffer et al. (1976) *7th LPSC*, 1391-1412 [3] Osinski and Pierrazzo (2012) *Impact Cratering: Processes and Products* [4] Newsom et al. (2011) *LPSC 42*, #1298; Wright and Newsom (2011) *LPSC 42*, #1619; Wright (2012) *LPSC 43*, #2765