The ejection-angle data indicate that the earliest material (closest to scaled launch position 0) left the growing crater at steeper angles than most of the material ejected later in the event. Until the advent of the EVMS, it was thought that ejection angles would be more or less constant throughout the formation of the crater. Instead, the data show that the ejection angles not only change but exhibit a more complex behavior than the ejection speeds. Not only do the angles exhibit considerably more scatter, but they also show a gradual decrease as the rim-crest location of the final crater is approached, whereupon they increase rather abruptly. This behavior has since been confirmed by other methods of measuring ejection angles, but its cause remains uncertain.

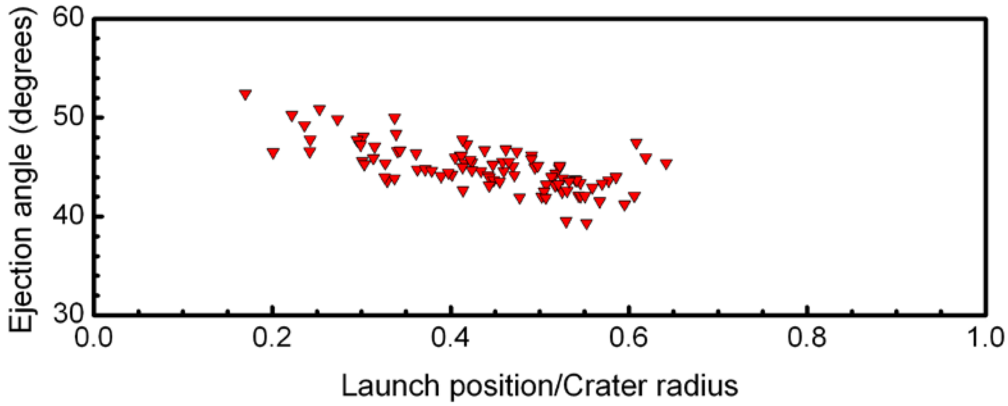

Figure 4.– Ejection angle (measured from the surface of the target) as a function of the scaled launch position. The angles scatter more than the ejection speeds (figure 3), indicating that factors not yet identified affect the geometry of the ejection process.

New Martian Meteorite Is One of the Most Oxidized Found to Date

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As of 2013, about 60 meteorites from the planet Mars have been found and are being studied. Each time a new Martian meteorite is found, a wealth of new information comes forward about the red planet. The most abundant type of Martian meteorite is a shergottite; its lithologies are broadly similar to those of Earth basalts and gabbros; *i.e.*, crustal igneous rocks. The entire suite of shergottites is characterized by a range of trace element, isotopic ratio, and oxygen fugacity values that mainly reflect compositional variations of the Martian mantle from which these magmas came. A newly found shergottite, NWA 5298, was the focus of a study performed by scientists within the Astromaterials Research and Exploration Science (ARES) Directorate at the Johnson Space Center (JSC) in 2012. This sample was found in Morocco in 2008 (figure 1; NWA stands for North West Africa). Major element analyses were performed in the electron microprobe (EMP) laboratory of ARES at JSC, while the trace elements were measured at the University of Houston by laser inductively coupled plasma mass spectrometry (ICPMS). A detailed analysis of this stone revealed that this meteorite is a crystallized magma that comes from the enriched end of the shergottite spectrum; *i.e.*, trace element enriched and oxidized (figure 2). Its oxidation comes in part from its mantle source and from oxidation during the magma ascent. It represents a pristine magma that did not mix with any other magma or see crystal accumulation or crustal contamination on its way up to the Martian surface. NWA 5298 is therefore a direct, albeit evolved, melt from the Martian mantle and, for its lithology (basaltic shergottite), it represents the oxidized end of the shergottite suite. It is thus a unique sample that has provided an end-member composition for Martian magmas.

Findings from the study of NWA 5298 were published in the journal *Meteoritics and Planetary Science*: Hui, H., Peslier, A. H., Lapen, T. J., Shafer, J. T., Brandon, A. D., Irving, A. J. (2011). Petrogenesis of basaltic shergottite Northwest Africa 5298: Closed-system crystallization of an oxidized mafic melt. *Meteor. Planet. Sci. 46* (9), pp. 1313-1328.

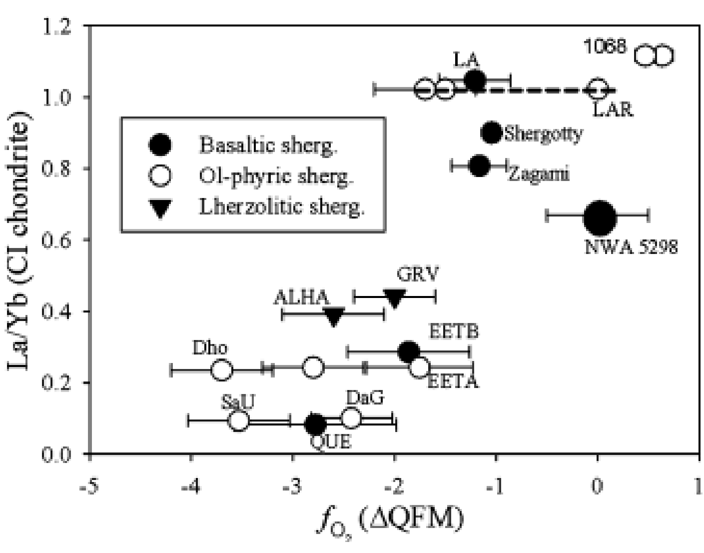

Figure 2.– Trace element (ratio of Lanthanum over Ytterbium) versus oxygen fugacity characteristics of NWA 5298 compared to those of other shergottites. NWA 5298 is enriched with trace elements and is the most oxidized basaltic shergottite that has been found to date.

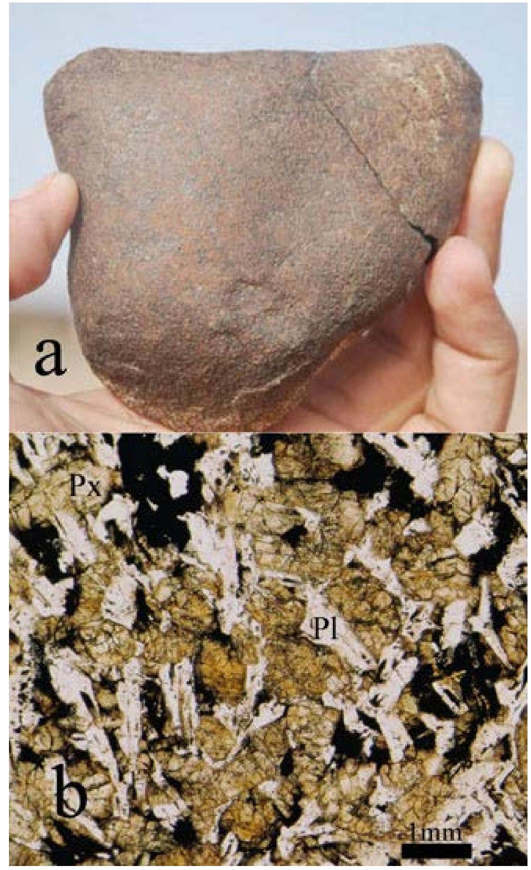

Figure 1.– (a) Photograph of the NWA 5298 meteorite showing its exterior. (b) A thin section of NWA 5298 seen under a microscope. The main minerals are pyroxene (Px) and plagioclase (Pl).