# MAGNETIC PROPERTIES OF AGGLUTINATE-LIKE PARTICLES FROM PLANAR SHOCK-RECOVERY EXPERIMENTS ON BASALTS.

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**Introduction:** Micrometeoroid bombardment represents a process that contributes to soil formation on the surfaces of airless solid solar system bodies such as the Moon and asteroids; its role in regolith evolution is comparable to that of crater-forming events. The main consequence of micrometeoroid impacts is agglutination, or the formation of clastic detritus bound by glass. Lunar agglutinates represent an important fraction of lunar soil (e.g., 16% in Apollo 16 [1]).

**Methods and materials:** We carried out hypervelocity impact experiments using a two-stage light gas-gun, where 5 mm spherical copper projectiles were directed towards four different types of basaltic targets with ~6 km/s impact velocities [2-3].

**Results:** Thermomagnetic analyses, hysteresis measurements and low-temperature magnetometry show that unshocked target basalts contain mostly single-domain and pseudo-single-domain, Ti-rich and Ti-free magnetite grains. Shock-recovery experiments resulted in the formation of agglutinate-like particles (ALP) similar in texture to lunar agglutinates. ALP include copper droplets ranging from 1 to ~600 µm, unmelted and partially melted basaltic clasts, as well as homogeneous and heterogeneous glasses [3]. ALP demonstrate shock-induced magnetic hardening (a 2 to 7 times increase in the coercivity of remanence $B_{cr}$) in comparison with the unshocked target materials, consistent with previous studies [4]. ALP also have decreased values of low-field magnetic susceptibility $\chi_0$ (2 to 7 times when compared with unshocked basalts). The presence of numerous copper droplets in the ALP inherited from the projectile is the likely cause of an increased frequency dependence of the 'out-of-phase' component of $\chi_0$ in the 10-300K (rather than shock-induced formation of nm-sized superparamagnetic grains). Our results have implications for terrestrial impact craters in basalts (e.g., Lonar impact structure, India), the Martian crust, where magnetite and titanomagnetite are present [5] as well as asteroidal and lunar surfaces.

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**References:** [1] Korotev R.L. 2010. *Geochim. Cosm. Acta 74: 7362-7388*. [2] Yakovlev O.I. et al. 1988. *19th LPSC*:1304-1305. [3] Bezaeva N.S. et al. 2011. 42nd LPSC: abs.#2826. [4] Gattacceca J. et al. 2007. *Phys. Earth Planet. Int.* 162: 85-98. [5] Bezaeva N.S. et al., *Geophys. Res. Lett.* 34, L23202.