# Physical properties of the Chelyabinsk LL5 chondrite — insight into shock-induced changes in asteroid regoliths

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The mineralogy and physical properties of Chelyabinsk meteorites (fall, February 15, 2013) are presented. Three types of meteorite material are present, described as the light-colored, dark-colored, and impact-melt lithologies. All are of LL5 composition with the impact-melt lithology being close to whole-rock melt and the dark-colored lithology being shock darkened due to partial melting of iron metal and sulfides. This enables us to study the effect of increasing shock on material with identical composition and origin. Based on the magnetic susceptibility, the Chelyabinsk meteorites are richer in metallic iron as compared to other LL chondrites. The measured bulk and grain densities and the porosity closely resemble other LL chondrites. Shock darkening does not have a significant effect on the material physical properties, but causes a decrease of reflectance and decrease in silicate absorption bands in the reflectance spectra. This is similar to the space-weathering effects observed on asteroids. However, compared to space weathered materials, there is a negligible to minor slope change observed in impact-melt and shock-darkened meteorite spectra. Thus, it is possible that some dark asteroids with invisible silicate absorption bands may be composed of relatively fresh shock-darkened chondritic material.

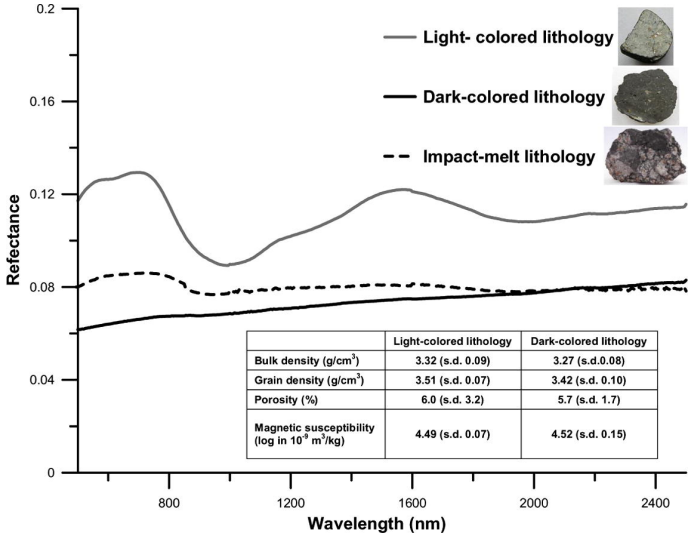


**Figure:** Reflectance spectra and physical properties of the Chelyabinsk meteorites.

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**References:** Kohout T., Gritsevich M., Grokhovsky V. I., Yakovlev G. A., Haloda J., Halodova P., Michallik R. M., Penttilä A., Muinonen, K. (2014): Mineralogy, reflectance spectra, and physical properties of the Chelyabinsk LL5 chondrite - insight into shock induced changes in asteroid regoliths. Icarus, 228, 78–85. DOI: 10.1016/j.icarus.2013.09.027