Weibull distribution of incipient flaws in basalt material used in high-velocity impact experiments and application in numerical simulations of small body disruptions

P. Michel (1) and A. Nakamura (2)

(1) UMR 6202 Cassiopée/CNRS, Côte d'Azur Observatory, France, (2) Graduate School of Science and Technology, Kobe University, Japan (michel@obs-nice.fr / Fax: +33 492-003-058 / Phone: +33 492-003-055)

We measured the Weibull parameters of a specific basalt material, called *Yakuno* basalt, which has already been used in documented high-velocity impact experiments. The outcomes of these experiments have been widely used to validate numerical codes of fragmentation developed in the context of planetary science. However, the distribution of incipient flaws in the targets, usually characterized by the so-called Weibull parameters, have generally be implemented in the codes with values allowing to match the experimental outcomes, hence the validity of numerical simulations remains to be assessed with the actual values of these parameters. Here, we follow the original method proposed by Weibull in 1939 to measure these parameters for this *Yakuno* basalt. We obtain a value of the Weibull modulus (also called shape parameter) m larger than the one corresponding to simulation fits to the experimental data. The characteristic strength, which corresponds to 63.2 % of failure of a sample of similar specimens and which defines the second Weibull or scale parameter is also determined. This parameter seems not sensitive to the different loading rates used to make the measurements. A complete database of impact experiments on basalt targets, including both the important initial target parameters and the detailed outcome of their disruptions, is now at the disposal of numerical codes of fragmentation for validity test. In the gravity regime, which takes place when the small bodies involved are larger than a few hundreds of meters in size, our numerical simulations have already been successful to reproduce asteroid families, showing that most large fragments from an asteroid disruption consist of gravitational aggregates formed by re-accumulation of smaller fragments during the disruption. Moreover, we found that the outcome depends strongly on the initial internal structure of the bodies involved. Therefore, the knowledge of the actual flaw distribution of the material defining the targets is required, especially in the strength dominated regime (body sizes below a few hundreds of meters) in which the small-scale physical properties of the bodies involved have a greater influence on the collisional outcome. We plan to define such physical properties for the targets made of different kinds of materials and which will be used in future impact experiments