GENERATION AND TRANSPORT OF IMPACT MELT.

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A series of continuum mechanics computer code calculations are being performed to investigate effects of variations in impactor mass and velocity on the generation and transport of impact melt and transient cavity dynamics. Results from the first two of these calculations have been reported (1). Two additional calculations (NASA-3 and NASA-4) are in progress and early-time results are reported here.

In all the calculations, the impacts are modeled as normal and axial symmetry is assumed. The calculations are performed using the two-dimensional Lagrangian continuum mechanics code WAVE-L. In all the calculations the impactor is modeled as an iron sphere and the target is taken to be a gabbroic anorthosite (GA) half-space. The equation of state used to model the iron is due to Tillotson (2). The equation of state used to model the GA target is very similar to that reported by Ahrens and O'Keefe (3) and includes a solid-solid phase transition beginning at a pressure of about 150 kb (15.GPa). Both the iron and GA are modeled with temperature dependent shear strength, shear strength going to zero at the melting point. All calculations contain 981 cm/sec^2 gravitational acceleration.

Initial conditions for the four calculations are:

	Projectile Mass (g)	Projectile Radius (m)	Impact Vel. (km/sec)	Momentum (10^{17} dynes-sec)	Kinetic Energy (10^{23} ergs)
NASA-1	1×10^{12}	31.2	5.	5.	1.25
NASA-2	1×10^{12}	31.2	15.8	15.8	12.5
NASA-3	1×10^{13}	67.2	5.	50.	12.5
NASA-4	1×10^{12}	31.2	50.	50.	125.

Total masses (grams) of vaporized and melted GA for the four calculations are:

	Fully Vaporized	Partially Vaporized	Fully Melted	Partially Melted
NASA-1	0	0	3.6×10^{10}	3.2×10^{10}
NASA-2	0	3.6×10^{12}	7.6×10^{12}	2.8×10^{12}
NASA-3	0	0	3.6×10^{11}	3.2×10^{11}
NASA-4	4.8×10^{12}	4.2×10^{13}	6.1×10^{13}	1.9×10^{13}

Original depths to which melting extends are:

NASA-1 ~15m
NASA-2 ~225m
NASA-3 ~30m
NASA-4 ~400m

In NASA-1 all the melted GA was ejected from the crater. In NASA-2 only about 50% of the melted GA was ejected from the crater. Calculation of the transport of melted GA for NASA-3 and NASA-4 as well as the transient cavity dynamics is in progress.

References:

1. Orphal D.L., Borden W.F., Larson S.A. and Schultz P.H. (1980) Proc. Lunar Planet. Sci. 11th, pp. 2309-2323.
2. Tillotson J.H. (1962). General Atomic Report GA 3216.
3. Ahrens T.J. and O'Keefe J.D. (1977). Impact and Explosion Cratering, pp. 639-656.