CATASTROPHIC DISRUPTION 2007

CD Workshops: Why??

SPECIFIC GOALS

- Cratering community had well developed scaling laws; extend to CD.
- Define needed experiments.
- Bring in meteoriticists, observers etc.


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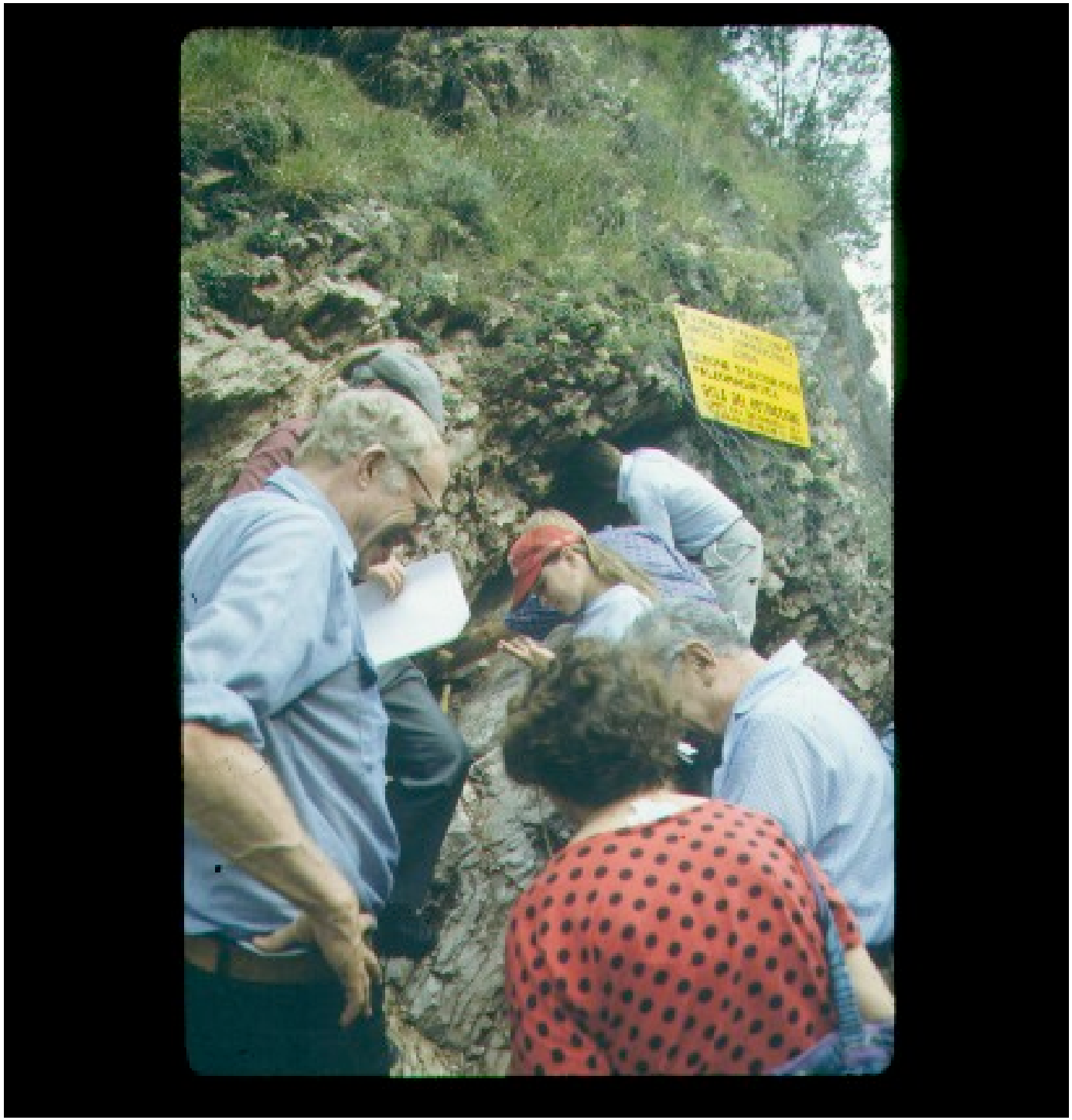

PROGRESS TOWARD CD GOALS

- SCALING AND MODELING: Very active community now; good progress.
- EXPERIMENTS: Steady level of experiments; validation of scaling (Housen). Need tests for porous bodies.
- OBSERVERS ETC: Much broader range of participants.

A FEW MEETING HIGHLIGHTS

- Using spectra to identify families (Bus, KB family).
- Dynamical chronometry (Bottke et al.
- Binary Stability States (Scheeres).
- Expanding power of computers and codes.

A FEW MEETING HIGHLIGHTS

- The first confirmed rubble pile (Cheng et al, O'Brien). Diversity.
- Vast increase in data on binaries, physical properties.
- Asteroid tomography - **REALLY** learn about rubble pile.
- Power of Arecibo for asteroid studies

EXPERIMENTS

- Interest in porous, layered and ice targets.
- BUT, a major purpose of lab experiments is to validate codes. We need to do a better job of measuring material needed by the hydrocodes.

HYDROCODES AND SCALING LAWS

- Powerful tools for understanding collisional and dynamical processes.
- Caveat pointed out by Benz
- Comprehensive collisional outcome algorithm.

ASTEROID SCIENCE

- Much progess in understanding relevant physics; eg, Yark, YORP.
- Vast increase in data, with the real deluge about to begin with Pan-STAARS.
- New paradigms for asteroid evolution.

SO, WHAT WILL CD08 BRING?

- A million or more known asteroids.
- Colors for several hundred thousand asteroids.
- Spectra and light curves for many tens of thousands asteroids.

SO, WHAT WILL CD08 BRING?

- Looking at asteroids by mass instead of numbers; we already have a variety of data on >95% of the mass of the asteroid belt. So, is adding data on a few more % going to provide breakthroughs?

SO, WHAT WILL CD08 BRING?

- Really determine the size-frequency distribution of small asteroids.
- Expand number of families.
- See collisions in near “real time”.

UNRESOLVED PROBLEMS

- The Vesta-Psyche dilemma.
- The “Great Dunite Shortage” and where are the iron parent bodies?
- Why are there no differentiated families?
- Does seismic shaking work on rubble piles?

UNRESOLVED PROBLEMS (CONT'D)

- What is the distribution of asteroid structures for different sizes - competent, fractured, rubble piles?
- What is the strength-gravity transition size for different structures?

"We know a lot less about asteroids than we did ten years ago."

(But that means we will all keep busy for some time..)

Thank you..

Holsapple SRGM Model"

The Equations:

Hoek Brown (Static Only)	Strain-Rate Geological Model
$\frac{\sigma_1-\sigma_3}{\sigma_c}=\left(m_b\frac{\sigma_3}{\sigma_c}+s\right)^a$ $m_b=m_i e^{\frac{GSI-100}{28-14D}}$ $s=e^{\frac{GSI-100}{9-3D}}$ $a=0.5+\frac{1}{6}\left(e^{\frac{-GSI}{15}}-e^{\frac{-20}{3}}\right)$ (2 parameter, m_i, GSI)	$\frac{Y_{nf}}{\sigma_c}=A\left(\frac{P}{\sigma_c}-\frac{P_T}{\sigma_c}\left(\dot{\varepsilon}^p\right)^\alpha\right)^n f(\varepsilon^p)h\left[\bar{T}(\rho)\right]$ $\frac{Y_f}{\sigma_c}=B\left(\frac{P}{\sigma_c}\right)^m f(\varepsilon^p)h\left[\bar{T}(\rho)\right]$ $G=\rho c^2\left(\frac{3(1-2\nu)}{2(1+\nu)}\right)h\left[\bar{T}(\rho)\right]\left(1-\frac{D}{2}\right)$ $Y=(1-D)Y_{nf}+DY_f$ $\dot{D}=\frac{\dot{\varepsilon}^p}{\varepsilon_f^p}$ $\varepsilon_f^p=D_1\left(\frac{P}{\sigma_c}-\frac{P_T}{\sigma_c}\left(\dot{\varepsilon}^p\right)^\alpha\right)^{D_2} h\left[\bar{T}(\rho)\right]$ $h(\theta)=1-\left(\bar{\theta}\right)^\beta$ $T_m=T_{mo}+\frac{\rho}{\rho_{HEL}}\left(T_{mh}-T_{mo}\right)$ $\bar{T}(\rho)=\frac{T-T_0}{T_m-T_0}$

Rate effect

Thermo effect

Damage Interpolation
Modulus degrades

Damage Accumulation

Failure plastic strain
depends on pressure

General melt effect

“ PROBLEMS WORTHY OF ATTACK, PROVE THEIR WORTH BY HITTING BACK”

Piet Hein, Grooks