ENERGY

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Drilling Into the Chicxulub Crater, Ground Zero of the Dinosaur Extinction

6 mile in diameter asteroid traveling at 16 km/s. Density of typical asteroid 3000 kg./m^3 . Source: Wikipedia

An artist's impression of what the Chicxulub crater might have looked like soon after an asteroid struck the Yucatán Peninsula in Mexico. Researchers studied the peak rings, or circular hills, inside the crater. Credit Detlev van Ravenswaay/Science Source

Some ***66 million years ago an asteroid crashed into the Yucatán Peninsula in Mexico,*** triggering the extinction event that obliterated the dinosaurs and nearly extinguished all life on Earth. **(((It struck with the same energy as 100 million atomic bombs, and left behind a 100-mile-wide scar known today as the Chicxulub crater.)))** Now, a team of geophysicists has drilled into the gigantic cavity under the Gulf of Mexico, targeting a circular series of hills called a peak ring located at its center. What they discovered illustrates that powerful impacts can catapult materials buried deep in a planet's crust much closer to its surface. "Chicxulub is the only crater on Earth with an intact peak ring that we can go sample, the next intact peak ring would be on the moon," said Sean P. S. Gulick, a marine geophysicist from the University of Texas at Austin. "It's ground zero of the Cretaceous extinction event."

INTRODUCTION: Goal of this application is to show the kinetic energy(1/2 m v^2) of asteroid is equivalent to energy of 100 million atomic bombs(2000 TerraJouls/ bomb).

QUESTIONS: (a) Find radius of asteroid in meters? (b) Find volume of asteroid in m^3 ? (c) Find mass of asteroid in kg.? , (d) Find kinetic energy of asteroid?

After collecting core samples filled with limestone and remnants of broken and melted rock, the team suddenly retrieved cores with pink granite. Credit D. Smith/European Consortium for Ocean Research Drilling

They reached the peak ring's granite around 2,500 feet below sea level, but they think it may have originated from crust that may have been more than 25,000 feet deep before the impact.

QUESTIONS (CONTINUED): (e) Convert energy in 100 million atomic bombs to Joules? , (f) How well did question (d) and (e) compare?

HINTS: 1609 m./mile , $V_{SPHERE} = 4/3\ \pi\ r^3$, density = ρ = m/V , T = terra = 10^{12} , Original atomic bombs had energy

In a range of 50 – 100 TJ. Modern atomic bombs are now in the 1000 to 2000 TJ range. We will use modern 2000 TJ/bomb in our calculations.

ANSWERS: (a) ~ 4827 m. = r , (b) ~ 4.7 X 10^{11} $m.^3$, (c) ~ 14.1 X 10^{14} kg. , (d) 1.8 X 10^{23} Joules ,(e) 2 X 10^{23} Joules

(f) Actual computed and stated equivalent to 100 M atomic bombs is quite close. Some assumptions in: size, speed, and density are values within a possible range from Wikipedia and NASA.