Revelation Revisited

(The following article is taken from pages 121 - 133 of the Time/Life book ***Comets, Asteroids, and Meteorites***. It is reproduced here in its entirety, with the exception of picture captions.)

A Fateful Rendezvous

Like creatures from another time, some eighty large asteroids periodically venture into Earth's vicinity, dark and swift and traveling at odd angles to the planetary plane. These rocky relics of the Solar System's birth are difficult to spot; scientists estimate their true number to be well over ten times the observed population. The battered face of the Moon testifies to the damage they can do if they collide with another celestial body: Countless craters - many as much as thirty miles across - pock the lunar landscape. From the craters' ages and distribution, planetary geologists have calculated that roughly once every 100 million years an object six miles in diameter hits the Moon. Because the orbits of the Earth and the Moon are so closely linked, this impact rate applies to Earth as well. Sooner or later, then, a monstrous asteroid will collide with the third planet.

Projecting what would happen if an asteroid struck Earth has occupied a number of researchers since 1980, when Luis and Walter Alvarez, of the University of California at Berkeley, published a paper linking the extinction of the dinosaurs 65 million years ago with the impact of a projectile several miles wide - a theory that now enjoys broad scientific support. Computer scenarios tracking the short- and long-term events associated with such a calamity recall biblical tales of fire, flood, and famine. One version, illustrated on the following pages, considers the slamming of a six-mile-wide meteorite into the ocean. The energy of the impact - equivalent to the explosion of five billion atom bombs - would transform cool, blue Earth into a flaming crucible. When the smoke cleared a transmuted planet would emerge: a hobbled and barren world, reeling toward some new destiny.

Free Fall

The thin veil of Earth's atmosphere would offer little resistance to a six-mile-wide, trillion-ton asteroid: Driving toward the ocean at 55,000 miles per hour - seventy times the speed of sound - the massive object would blast the air aside, heating the surrounding atmosphere to about 55,000 degrees Fahrenheit. Air molecules, stripped of their electrons by the extreme temperature, would cloak the meteorite in a blazing envelope of visible, ultraviolet, and infrared radiation. Out of this incandescence, a reddish brown smog would materialize: Ionized oxygen and nitrogen would react to form acrid-smelling nitrogen oxide compounds - the progenitors of acid rain. All of this would happen in a fraction of a second.

As the front edge of the huge projectile struck the ocean, impact shocks would instantaneously raise the temperature of the seawater to 100,000 degrees, flash boiling eight trillion tons of brine. Vast jets of vapor would rocket skyward while the asteroid, only three-quarters of a second from seabed impact, would begin a kind of death rattle as rebounding shocks raced through it's core.

Impact

When the monster made contact with the ocean bed, 100 million megatons of energy would be released, eventually shaking the entire planet. With a stupendous crack of thunder and a blinding flash of light, 100 trillion tons of ocean bedrock and vaporized meteorite and 130 billion trillion gallons of seawater would shoot outward from the impact site at 25,000 miles per hour. In the passage of only three minutes, an expanding fireball of steam and molten ejecta would level any city within 1,200 miles and scour the terrain down to bedrock.

The immense crater produced by the impact, initially 16 miles deep and 200 miles wild, would shrink to a depth of one-third of a mile and a width of 60 miles as the underlying mantle rebounded and ocean sediments washed inward. Overhead, shock waves from the explosion would heat the air to more than 3,000 degrees Fahrenheit, generating searing hurricane-force winds that would rack the stricken planet for fifteen to twenty hours.

Tsunami

The devastating blow delivered by the meteorite would trigger a shift in the seabed 100,000 times more powerful than the earthquake that shook San Francisco in 1906. The cataclysmic ground movement would give rise to a ring of seismic sea waves, or tsunamis, nearly as high as the Rocky Mountains and three to four miles wide.

Were the asteroid to strike in the middle of the Gulf of Mexico, the colossal water walls would travel outward at some 450 miles per hour, making landfall simultaneously in New Orleans, Tampa, Havana, and Merida in the Yucatan. Because of the shallowness of the coastal plains in this region, the waves would roll unchecked as far inland as Kansas City, surge across much of Mexico and Central America, and ravage Florida and the Caribbean Islands. Untold numbers of animals would drown, and two million square miles of land would be swamped with silty floodwaters.

Secondary waves spawned by the aftershocks and the settling of the crater walls would pound ashore every seven minutes for hours. The relentless churning of the ocean near the impact site would drag warm coastal waters to great depths, suffocating fish and depriving delicate marine organisms of light; frigid bottom waters would inundate reefs and plankton colonies. Decades - perhaps centuries - would pass before all aftershocks ceased and wave patterns returned to their normal state.

Darkness

Like tiny, incendiary ballistic missiles, trillions of tons of microfine rock particles and condensed vapor droplets thrown up by the asteroid impact would soar spaceward, reaching stratospheric heights within seconds. There, in the weatherless realm some thirty miles above the clouds, the fiery grains would rouse violent currents in the cold, thin air.

Propelled by these abnormal winds, the particulates would begin to spread over the planet. One theory holds that as the fastest-moving dust grains collided with atmospheric molecules, the resulting friction would impart more energy to each particle than is contained in an equivalent mass of TNT. Ablaze with quadrillions of these glowing bullets, the sky would radiate enough heat to raise the air temperature at an altitude of forty miles to 1,800 degrees. On the ground, temperatures would climb to 600 degrees. Lasting at least an hour and probably longer, the heat pulse would ignite land regions baked dry by the earlier blast winds from the fireball. Creatures unable to shelter themselves from the inferno would be incinerated. Scientists speculate that as much as 90 percent of the world's forests and grasslands untouched by earlier ravages might burn. Soot from the fires mixed with nitrogen oxide smog produced by the initial and subsequent shock waves would combine with the rapidly spreading dust to form a shroud seventeen miles thick. It would envelope the entire planet within twenty-four hours. Computer simulations indicate that no sunlight could penetrate such a pall; the surface of Earth would be locked away in a blackness thirty times more inky than the darkest moonless night. For as long as six months, photosynthesis would halt, causing all but the hardiest Arctic plankton to die off and triggering the collapse of the marine food chain. Depending on the season, land plants not already burned would die as well.

Requiem

From the globe-girdling miasma, a deadly rain would begin to fall: The cloud's burden of water vapor would gradually condense out, mixing with nitric oxides to form precipitation as corrosive as battery acid. The toxic rainfall would defoliate any remaining land plants, acidify lakes, and leach normally insoluble, highly poisonous metals from soils and rocks, depositing them in streams, ponds, and rivers, where they would sicken or kill much of the surviving aquatic life. In the oceans, the influx of the strong acid would dissolve carbonaceous organisms, releasing tons of carbon dioxide into the atmosphere.

Despite the sudden injection of this greenhouse gas, the Earth would rapidly grow cold under it sodden canopy. The surface, shielded utterly from the Sun's rays, would quickly radiate away its store of heat. Within ten days of impact, temperatures would plunge to subfreezing. The global winter might last as much as six months. Even if its duration were only half that long, snow formed from acid rain would blanket the continents with a twenty-foot-thick layer of sooty nitric and nitrous acid crystals. The darkness and snow would prevent most larger animals from finding food, and they would starve. Smaller mammals adapted to the cold could conceivably forage for decaying vegetation and stay warm by tunneling underground. Fish and other lake organisms that survived the acid bath could subsist on rotting plant matter for a time.

Gradually, as the dust and soot settled or was washed out of the atmosphere - a process that would take a year or more - sunlight would again reach Earth's surface. Stripped of their particulate mantle, residual water vapor and nitrogen oxide gases in the atmosphere would admit incoming solar rays but trap outgoing infrared radiation. The carbon gasses liberated from the oceans would contribute to this effect, swaddling the planet in a moist and steamy cocoon for perhaps as much as two millennia. Life would slowly reemerge - diverse and abundant, but perhaps very different from the creatures that inhabited Earth before catastrophe struck.