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“It’s the end of the world as we know it and I feel fine” (Berry, Buck, Mills & Stipe, 1987)

Extinction has been documented as a natural process. According to the Columbia Electronic Encyclopedia (2011), the five greatest mass extinctions occurred in the following order: Ordovician, 435 million years ago; late Devonian, 357 million years ago; final Permian, 250 million years ago; late Triassic, 198 million years ago; and final Cretaceous, 65 million years ago. The combined effect of each of these, and other less massive events, is the estimate that more than 95% of the entire world’s species has become extinct (‘Columbia Electronic Encyclopedia, 2011; Merali, 2006, p. 18) since the beginning of time. Shockingly, most experts and scientists are in agreement; we are currently experiencing a mass extinction (Cooper, 2000, p. 2; Benton, 2011, p. 8; Stork et al., 2009, p. 1438). Understanding more about past extinctions can provide a roadmap for the future. In fact, leading scientists in the 1980s believed they had identified a pattern that could predict future extinction events (Benton, 2011, p. 1). While the course will not change, we could use the knowledge to lessen the effects or at least reduce humanity’s acceleration of the inevitable.

During good times, specifically prior to the Devonian crisis, the world’s environment and all life it supported, enjoyed relative abundance and balance. The air and water were clean, food sources were plentiful, and there was harmony in the cycle of life and regeneration. Seas teemed with conical-shaped marine life known as homoctenids (Bond, 2006, p. 167). In fact, at the same time the wealth of

stromatoporoid coral reefs (Keller, 2005, p. 745) was supported by the same favorable underwater conditions. During the early cretaceous era, terrestrial species such as dinosaurs, roamed freely. Their needs for vast feeding range and specialized diet were met by lush, herbaceous habitat (Benton, 2011, p. 6). However, these specific needs proved to be the vulnerability of the dinosaur.

The first line in a song made popular by R.E.M. states '...it starts with an earthquake' (Berry, Buck, Mills & Stipe, 1987). Although a bit oversimplified, that lyric indeed has an element of truth. In 1980 physicist Luis Alvarez and his team determined that the high concentration of iridium found in Gubbio, Italy marked the location of a meteor strike that triggered the mass extinction at the end of the Cretaceous era. Several other concentrations of iridium found around the world offer support to this concept. Although many believe massive a meteor strike contributed greatly to the most recent mass extinction event (Benton, 2011, p. 3; "Columbia Electronic Encyclopedia", 2011), which caused the dinosaur to disappear, data exists to refute claims that impact events were part of other extinctions. A significant number of experts assert that a review of extinctions provides no support for the claim that meteor impacts have made any significant contribution to extinction events (Keller, 2005, p. 725; Merali, 2006, p. 18), rather merely had coincidental timing. The disagreement continues over the true effects of meteor collisions with earth, yet there is consensus that environmental factors originating within earth's atmosphere are the driving force behind extinction events.

During the late Devonian era, volcanic eruptions are the primary markers for this time and for almost all major and minor extinction episodes (Keller, 2005, p. 729). Data exists that indicates tectonic shifts, and the resulting volcanism, spewed massive clouds

of CO₂ into the atmosphere (Benton, 2011, p. 1). The resulting greenhouse effect caused global warming, the first major catalyst in a series of events to cause mass extinction. Support for this assertion is found in carbon isotopes in rocks which reveal the amount of carbon dioxide in the atmosphere during the Triassic extinction to be up to 100 times what it is today. Further study reveals that CO₂ levels fluctuated wildly over the next few tens of thousands of years (Merali, 2006, p. 18). In contrast, the climate recovered relatively rapidly after the Cretaceous event. The biotic crisis of the Late Devonian Frasnian – Famennian era was marked by significant volcanic eruptions that dumped huge quantities of viscous basalt lava under water affecting sea level and triggering ocean anoxia. These events caused multiple species to become extinct under the surface (Keller, 2005, p. 745).

The time needed to reestablish under sea life is considerable compared to land animals and vegetation. According to Wood, the complex biodiversity and interaction of multiple ecological factors cause tropical reef communities to rebuild at a slower pace than on land (2004, p. 417). Certainly others agree citing reefs that disappeared during the Permian event were not rebuilt for 15 million years (Benton, 2011, p. 1). The course may be slow, but progress is made. The end-Permian mass extinction offered opportunities to surviving sea species such as bivalves and gastropods to fill voids left by extinct brachiopods. Reefs were rebuilt by scleractinian corals providing habitat for a new light-scaled fish that replaced more primitive varieties (Benton, 2011, p. 5).

Tiny, outwardly invisible elements can have huge and profound effects. To illustrate this claim, consider the additional genetic material in human DNA which results in Down's syndrome. Arguably this is a significant handicap that limits mental

capabilities, physical processes and overall lifespan in those who have it, yet this additional gene can only be seen microscopically. Comparing man to earth, consider any satellite image of the earth as a whole and it is impossible to see man. Although our presence can only be confirmed under increased magnification, our effect on the globe is certainly intense.

Since the beginning of the industrial revolution, just a few generations ago, man's consumption of fossil fuels has caused a significant change in air quality. The current measurements of CO₂ in the atmosphere are increasing 100x faster than at any other time in the last 650,000 years (Guinotte & Fabry, 2008, p. 321). While there is undisputed data to support several extinction events throughout history caused by natural processes, man's contribution presents a new element to factor into the equation. Thomas Lovejoy, chief biodiversity advisor at the World Bank, places us at the beginning of the extinction process (Cooper, 2000, p. 3); as does Peter Ward at the University of Washington in Seattle (Merali, 2006, p. 18). It seems man's influence is not multiple but exponential. In addition to air quality, water supply, terrestrial species and weather patterns are also affected.

Of all the untoward effects on Earth's oceans, the most is known about the calcification response of corals in shallow water (Guinotte & Fabry, 2008, p. 336). This data can be used to identify 'tipping points' and avoid irreparable damage. Unfortunately, this knowledge may come too late. Accurate predictions of ensuing extinctions are limited due to the time lag before the extinction actually occurs (Stork et al., 2009, p. 1439). As the global climate changes and polar ice packs continue to melt, sea levels are predicted to rise blocking available light for photosynthesis limiting coral

growth in deep areas of the photic zone (Guinotte & Fabry, 2008, p. 326). This crisis is not contained beneath the water's surface but has crept up onto solid ground.

Documented climate fluctuations have caused seasonal changes to occur earlier, which in turn trigger adjustments in wildlife migratory patterns. Experts predict that by 2100 more than 50% of the plants and insects in a specific range in Costa Rica are likely to be driven upslope in range shifts (Stork et al., 2009, p. 1440) and other species, like the golden toad last seen by scientists in 1989 (Cooper, 2000, p. 1), to disappear completely. The current losses of animal, plant and marine life is swiftly approaching the same scale as the mass extinction that claimed dinosaurs and has the potential to permanently alter food supplies, medicinal plant life and weather patterns (Cooper, 2000, p. 2).

The sober facts and opinions presented above can indeed inspire despair in the reader. Therefore, it is important to point out that many strides have been made to stem the damage man has done to the environment. Since its inception in 1970, the US Environmental Protection Agency has increased general awareness of critical environmental issues and been credited with influencing positive changes around the world (US EPA, 2011). Simply by developing a scale to measure air quality, and providing regular reports to the public, industries and governments have been pressured, and in some cases, legally required to modify damaging practices, reduce dangerous emissions and be more environmentally responsible. The US EPA is only one of many organizations that focuses on preserving our world and its resources and is by far not the most influential or active. "Therefore did my heart rejoice, and my tongue was glad; moreover also my flesh shall rest in hope" (Acts 2:26, King James Version)

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