The Toba Catastrophe / Supereruption - By Advocate De Waal Lubbe

The Toba supereruption occurred between 69,000 and 77,000 years ago at Lake Toba (Sumatra, Indonesia), and it is recognized as one of the earth's largest known eruptions. The related catastrophe theory holds that this supervolcanic event plunged the planet into a **6-to-10-year volcanic winter**

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which resulted in the world's human population being reduced to 10,000 or even a mere 1,000 breeding pairs, creating a

bottleneck

in human evolution. Some researchers argue that the Toba eruption produced not only a catastrophic volcanic winter but also an additional 1,000-year cooling episode.

The Toba eruption was the latest of three major eruptions which occurred at Toba in the last 1 million years. Although the Toba eruption took place in Indonesia, it deposited an ash layer approximately 15 centimetres thick, over the entirety of South Asia. A blanket of volcanic ash was also deposited over the Indian Ocean, and the Arabian and South China Sea. **Deap-sea cores retrieved from the South China Sea extended the known distribution of the eruption and suggest that the ~2,800 km**

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calculation of the eruption magnitude is a minimum value or even an under-estimate.

According to Alan Robock (Robock and others 2009), the Toba incident did not initiate an ice age. Using an emission of 6,000 million tons of sulphur dioxide, his simulations demonstrated a maximum global cooling of around 15°C approximately 3 years after the eruption. As the satured adiabatic lapse rate is 4.9 °C/1,000 m for temeratures above freezing, this means that the tree line and the snow line were around 3,000 m (9,000ft) lower at this time. Nevertheless, the climate recovered over a few decades.

Robock found no evidence that the 1,000 year cold period seen in Greenland ice core records was directly generated by the Toba eruption. Nevertheless, he argues that the volcanic winter would have been colder and longerlasting than assumed, which strengthens his argument for a genetic bottleneck. Contrary to Robock, Oppenheimer (Openheimer 2002),believes that estimates of a surface temperature drop of 3-5°C after the eruption are probably too high.

Despite the different approaches and estimates, scientists agree that a supereruption like the one at Lake Toba must have led to very extensive ash-fall layers and injection of noxious gases into the atmosphere, having severe worldwide effects on climate and weather.

According to the supporters of the **genetic bottleneck** theory, between 50,000 and 100,000 years ago, human population suffered a severe population decrease -only 3,000 to 10,000 individuals survived- followed eventually by rapid population increase, innovation, progress and migration. Several genetics, including Lynn Jorde and Henry Harpending have proposed that the human race was reduced to approximatley five to ten thousand people. Genetic evidence suggests that all humans alive today, despite apparant variety, are descended from a very small population, perhaps between 1,000 to 10,000 breeding pairs about 70,000 years ago.

Genetic bottlenecks related to the human population

Human parasite: analysis of louse genes

Alan Rogers, a co-author of his study and professor of anthropology an the University if Utah, says: "The record of our past is written in our parasites". Rogers and others have proposed the **bottleneck**
may have occurred because of a mass die-off of early humans due to a globally catastrophic volcanic eruption. The analysis of louse genes confirmed that the population of Homo sapiens mushroomed after a small band of early humans left Africa sometime between 150,000 and 50,000 years ago.

Human pathogen: analysis of Helicobacter pylori genes

Recent research states that genetic diversity in the pathogenic bacterium Helicobacter pylori decreases with geographic distance from Africa , the birthplace of modern humans. Using the genetic diversity data, the researchers have created simulation that indicate the bacteria seem to have spread from Africa around 58,000 years ago. Their results indicated modern humans were already infected by H. pylori before their migrations out of Africa, and H. pylori remained associated with human hosts since that time.

Genetic bottleneck of other mammals

The population of the Eastern African chimpanzee, Bornean orangutan, central Indian macaque the Cheetah - and all tigers, and the separation of the nuclear gene pools of eastern and western lowland gorillas, all recovered from very low numbers around 70,000-55,000 years ago.

Migration after Toba

It is currently not known where human populations were living at the time of the eruption. The most plausible scenario is that all the survivors were populations living in Africa, whose descendants would go on to populate the world.

Recent analysis of mitochondrial DNA have set the estimates for the major migration from Africa from 60,000 - 70,000 years ago, around 10-20,000 years earlier than previously thought, and in line with dating of the Toba eruption to around 66,000-76,000 years ago. During the subsequent tens of thousands of years, the descendants of these migrations populated Australia, East Asai, Europe, and finally the Americas.

Oppenheimer argues that it is difficult to estimate the global end regional climatic impacts of the eruption, and, at the same time, cannot conclude with any confidence that the eruption actually proceeded the / a bottleneck. (Oppenheimer 2002).

Furthermore, 2010 geneticists' study seems to question the foundation of the Toba bottleneck theory: as Alu sequences across the entire human genome has shown that the effective human population was already low before Toba, suggesting that no Toba bottleneck was necessary. Possible explanations fot the low population size of human ancestors may include repeated population bottlenecks or periodic replacement events from competing Homo subspecies. (Huff & Others 2010).

The genetic trail / genetic research of modern humans, as set out above, is 100 % in line with the archeological findings of prof. Curtis Marean in Mossel Bay, South Africa. See: *When the*

Sea Saved Humanity,
prof. Curtis Marean, Scientific American - August 2010
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There is great scope for more interaction among anthropologists and population geneticists.