

must read and correlate *all* elements of the records and we are only just beginning the process. Discussions of the Cretaceous-Tertiary 'boundary' fail to take into account the very rapid oceanic regression accompanied by erosion of soils that cut into the late Mesozoic record and tumbled it into the seas. Species of life do not die off so fast as all that — especially so selectively. It was the *record* of their existence that was suddenly wiped clean.

"I feel the extinction process took place over tens or hundreds of thousands of years," he continues, "allowing some species to adapt to changing conditions while eliminating others. The initiating event was the almost indecent haste shown by the subcontinent of India in breaking off its attachment with Gondwanaland and crossing the equator to consummate its present liaison with Asia. The movement precipitated one of the greatest outpourings of lava on record as India passed over a group of deep mantle 'plumes'. Volcanic gases upset the carbon balance in the atmosphere and seas and reduced oceanic pH values. Expelled carbon dioxide in the upper atmosphere trapped heat and elevated the temperature enough to stop the reproductive capacity of the big reptiles, but allowed the smaller animals to continue. Magma from the plumes well up from close to the core-mantle boundary, much lower than normal volcanoes. The deep origins of the plumes *could* account for the iridium anomaly — distributing the noble metals around the world in volcanic ash."

Symposium participants were unanimous in expressing interest in the iridium discoveries and stressed the stimulation for new research they provided. Discussions of future work centered on the need for more detailed biological investigations, including, for example, explanations of why so many insect pollinated plants were replaced by wind pollinated ones. Was this due to changes in environmental chemistry or climatic changes as yet poorly understood? More statistics on which micro life forms survived and which extinguished were called for, as were suggestions that trace element and isotope analyses be carried out on the fossil records. Astronomers will seek more information on the composition and fractionation of earth impacting bodies. Voyager's images of Saturn's ring system, especially the bizarre

kinks, are forcing astrophysicists to reconsider many questions regarding planetary close encounters with their smaller neighbors. Finally, scientists who understand atmospheric transport mechanisms will consider whether an asteroid could produce a dust cloud that could block almost all sunlight and be sustained in the atmosphere long enough to bring a halt to photosynthesis. Luis Alvarez' contention that the asteroid's visit produced "many times over the conditions generated by the Krakatoa volcano in 1883" will have to await the next symposium on the Cretaceous-Tertiary Environmental Change for evaluation. □

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For further reading

Alvarez, L., Alvarez, W., Asaro, F., Michel, H.V.; "Extraterrestrial Cause for the Cretaceous — Tertiary Extinction." *Science*, Vol. 208, p. 1095 (6 June 1980)

Beland, P. and others; "Cretaceous — Tertiary Extinctions and Possible Terrestrial and Extraterrestrial Causes" *Syllogeus* No. 12, National Museums of Canada, Ottawa, 1977.

McLean, D.M. "A Terminal Mesozoic Greenhouse" *Science*, Vol. 201, p. 401 (4 August 1978).

Russell, D.A. *A Vanished World*, National Museum of Natural Sciences, Ottawa 1977.

What was lost?

Long before movie screens were infested with the image of a black rodent sporting red Bermuda shorts, white gloves and brogues, theatre-goers enjoyed the animated cartoon antics of an ancient giant lizard known as Gertie the Dinosaur. Since the discovery of reptile fossils early in the 19th century, mankind has been intrigued by the origins, size and disappearance of the creatures who ruled the earth for 130 million years. Gertie represented the prevailing view of the dinosaurs during the early years of this century — ponderous, gigantic, possessing only sufficient intellect to maintain a precarious, plodding existence.

Dale Russell, paleobiologist with Canada's National Museum of Natural Sciences and organizer of the K-TEC symposia, deplores the persistence of the retarded behemoth viewpoint. He has studied the full reach of physical development of the dinosaurs and derived some conclusions about intellectual progress. "The rate of encephalization of animal life underwent an increase about 200 million years ago," he contends. "According to the older rates of increase, a human level of 'brain power' would have been attained about 60 million years ago. Development of intelligence among land animals results from diverse environmental condi-

tions, among other things. For example, land conditions can be contrasted to oceanic life where the highest levels of intelligence are exhibited by those animals and birds which reinvaded the seas from the land. Terrestrial circumstances of competition, size, mobile versus static defence methods, body metabolic rates in the face of changing climates — these are conditions contributing to intellectual growth. How these elements combine to improve intellect is far from clear, but it offers an area ripe for further investigation.

"Canada is in a particularly opportune position to pursue these questions," he continues, "because of the extensive fossil remains found on the Prairies. Dinosaur diversity seems to have increased over time and the fossils are stimulating fresh thinking on what developments were taking place at the time of the extinctions. Carnivorous dinosaurs were evolving into bipedal, highly mobile creatures with grasping forefeet, stereoscopic vision and an intelligence approaching that of some modern mammals. Given more time, they could have fulfilled a trend toward temperature tolerance similar to that of birds. Where these trends might have led is purely speculative, but it is easy to imagine an upright saurian about 2 m tall, weighing about 75 kg with a brain capacity and grasping ability that could enable it to modify its environment to suit its needs."