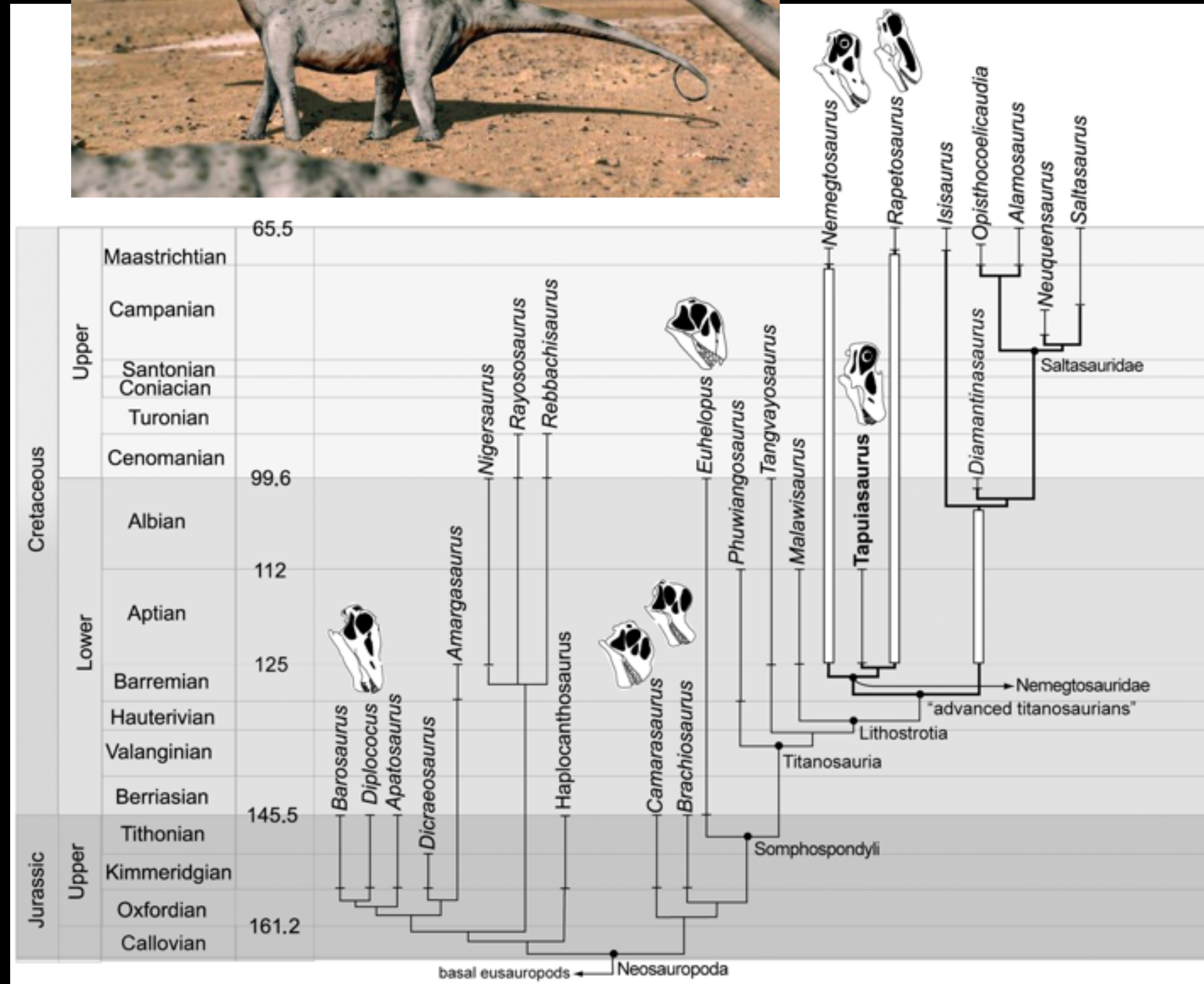


# Speciation and Extinction



**Evolution**

**Environment**

**Speciation**

**Extinction**

**Adaptive  
radiation**

**Mass  
extinctions**

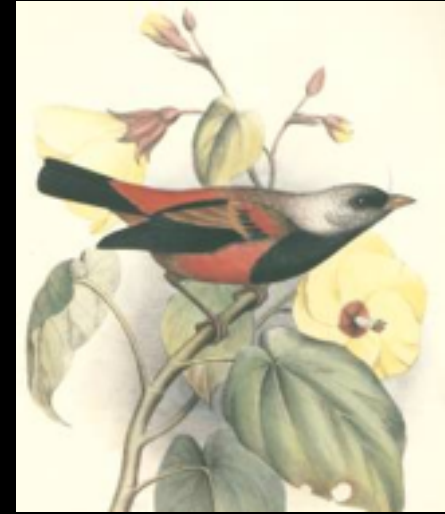


Three-spined Stickleback

fully-armored  
low-armored

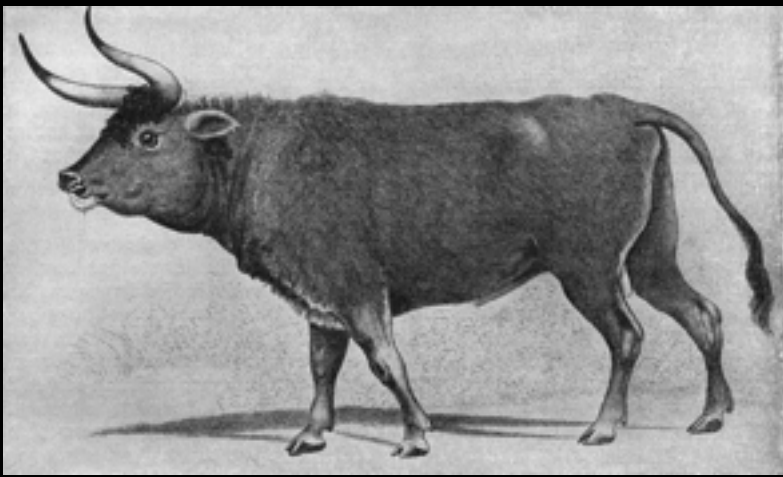


# Speciation

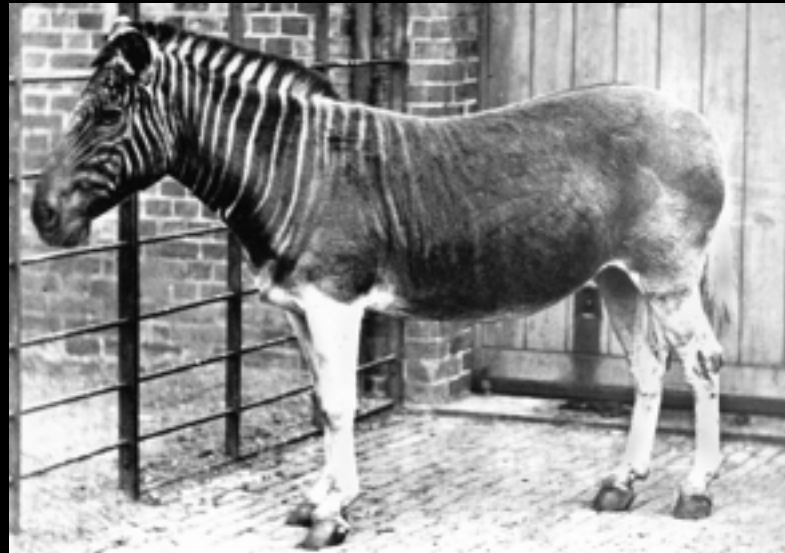


# Adaptive Radiation

99.9% of all species that have ever existed are now extinct



Auroch



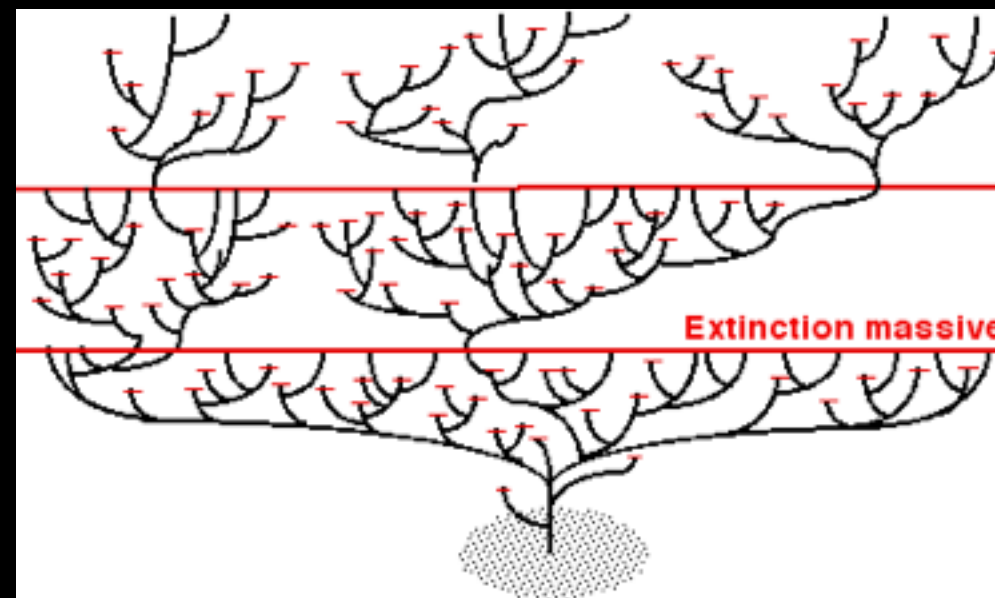
Quagga



Thylacine



Great Auk



# Extinction



Golden Toad

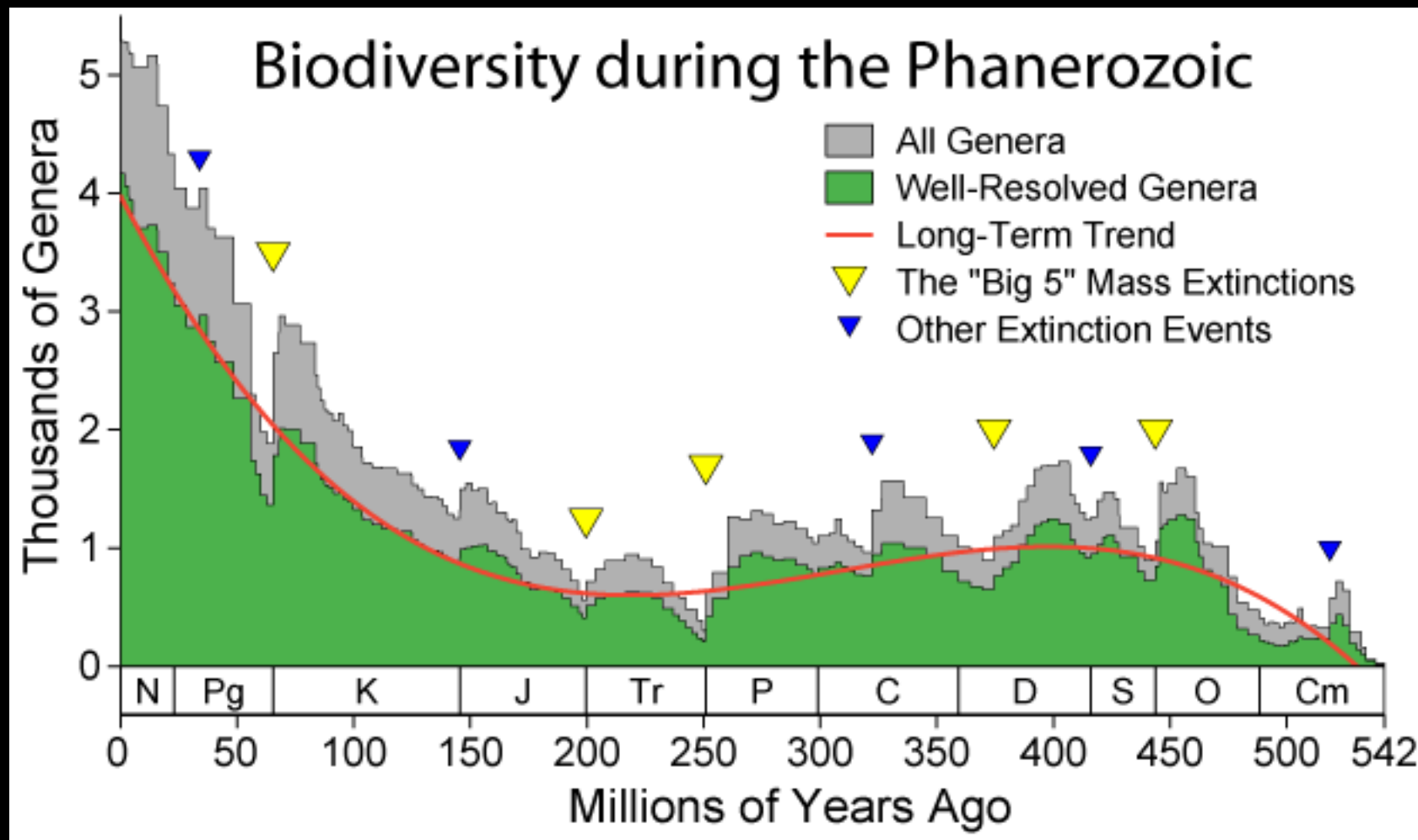
Comet

CO<sub>2</sub>

Pangaea

Volcanoes

Gamma Rays



Sea Level

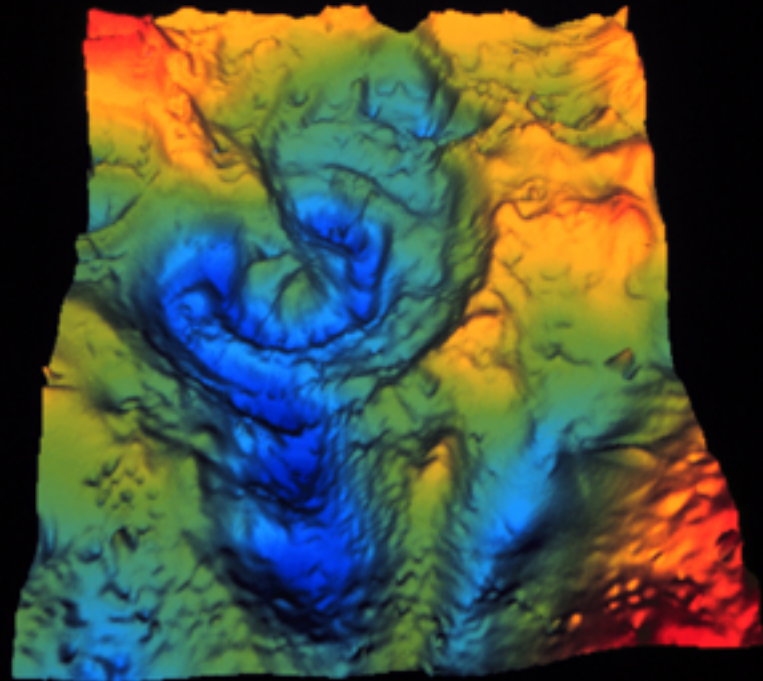
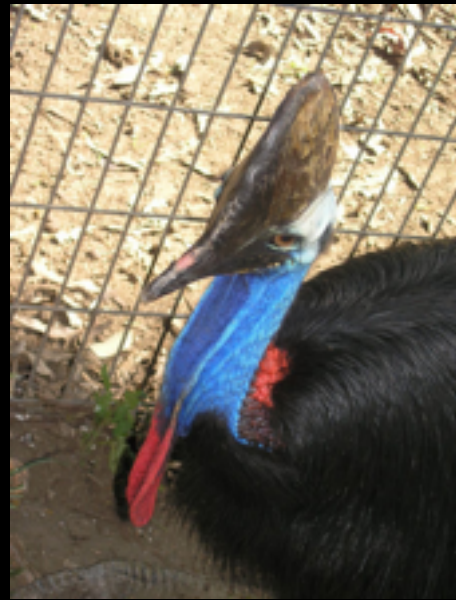
Climate Change

Methane Hydrate

Ocean Anoxia

Ocean Circulation

# Mass Extinctions



# K-T Extinction Event

## Acknowledgements

bica, paul. *Waipio Valley*, January 27, 2011. <http://www.flickr.com/photos/dexxus/5499821986/>.

Davis/NASA, Don. *English: K/T Extinction Event Theory. An Artist's Depiction of the Asteroid Impact 65 Million Years Ago That Many Scientists Say Is the Most Direct Cause of the Dinosaurs' Disappearance [1]*., [object HTMLTableCellElement]. [http://solarsystem.jpl.nasa.gov/multimedia/display.cfm?IM\\_ID=2306](http://solarsystem.jpl.nasa.gov/multimedia/display.cfm?IM_ID=2306). [http://commons.wikimedia.org/wiki/File:Coast\\_Impact.jpg](http://commons.wikimedia.org/wiki/File:Coast_Impact.jpg).

“File:Bufo Periglenes2.jpg.” *Wikipedia, the Free Encyclopedia*, October 25, 2013. [http://en.wikipedia.org/w/index.php?title=File:Bufo\\_periglenes2.jpg&oldid=507556728](http://en.wikipedia.org/w/index.php?title=File:Bufo_periglenes2.jpg&oldid=507556728).

*File:Cassowary-head.jpg*, n.d. <http://commons.wikimedia.org/wiki/File:Cassowary-head.jpg>.

*File:Chicxulub2.jpg*, n.d. <http://en.wikinews.org/wiki/File:Chicxulub2.jpg>.

“File:Darwin's Finches by Gould.jpg.” *Wikipedia, the Free Encyclopedia*. Accessed November 9, 2013. [http://en.wikipedia.org/wiki/File:Darwin%27s\\_finches\\_by\\_Gould.jpg](http://en.wikipedia.org/wiki/File:Darwin%27s_finches_by_Gould.jpg).

“File:Darwin's Finches by Gould.jpg.” *Wikipedia, the Free Encyclopedia*. Accessed November 9, 2013. [http://en.wikipedia.org/wiki/File:Darwin%27s\\_finches\\_by\\_Gould.jpg](http://en.wikipedia.org/wiki/File:Darwin%27s_finches_by_Gould.jpg).

“File:Drepanis funerea-Keulemans.jpg.” *Wikipedia, the Free Encyclopedia*. Accessed November 5, 2013. [http://en.wikipedia.org/wiki/File:Drepanis\\_funerea-Keulemans.jpg](http://en.wikipedia.org/wiki/File:Drepanis_funerea-Keulemans.jpg).

“File:Grote Alk -KBIN-.jpg.” *Wikipedia, the Free Encyclopedia*. Accessed November 5, 2013. [http://en.wikipedia.org/wiki/File:Grote\\_alk\\_-KBIN-.jpg](http://en.wikipedia.org/wiki/File:Grote_alk_-KBIN-.jpg).

“File:HemignathusKeulemans.jpg.” *Wikipedia, the Free Encyclopedia*. Accessed November 5, 2013. <http://en.wikipedia.org/wiki/File:HemignathusKeulemans.jpg>.

“File:Himatione Sanguinea.jpg.” *Wikipedia, the Free Encyclopedia*. Accessed November 5, 2013. [http://en.wikipedia.org/wiki/File:Himatione\\_sanguinea.jpg](http://en.wikipedia.org/wiki/File:Himatione_sanguinea.jpg).

“File:Iiwi.jpg.” *Wikipedia, the Free Encyclopedia*. Accessed November 5, 2013. <http://en.wikipedia.org/wiki/File:Iiwi.jpg>.

“File:K-T-boundary.JPG.” *Wikipedia, the Free Encyclopedia*. Accessed November 5, 2013. <http://en.wikipedia.org/wiki/File:K-T-boundary.JPG>.

“File:Laysanfinchr.jpg.” *Wikipedia, the Free Encyclopedia*. Accessed November 5, 2013. <http://en.wikipedia.org/wiki/File:Laysanfinchr.jpg>.

“File:Mammal Diversity 2011.png.” *Wikipedia, the Free Encyclopedia*. Accessed November 9, 2013. [http://en.wikipedia.org/wiki/File:Mammal\\_Diversity\\_2011.png](http://en.wikipedia.org/wiki/File:Mammal_Diversity_2011.png).

“File:Phanerozoic Biodiversity.png.” *Wikipedia, the Free Encyclopedia*. Accessed November 5, 2013. [http://en.wikipedia.org/wiki/File:Phanerozoic\\_Biodiversity.png](http://en.wikipedia.org/wiki/File:Phanerozoic_Biodiversity.png).

“File:Quagga Photo.jpg.” *Wikipedia, the Free Encyclopedia*. Accessed November 5, 2013. [http://en.wikipedia.org/wiki/File:Quagga\\_photo.jpg](http://en.wikipedia.org/wiki/File:Quagga_photo.jpg).

“File:Tapuiasaurus NT.jpg.” *Wikipedia, the Free Encyclopedia*. Accessed November 5, 2013. [http://en.wikipedia.org/wiki/File:Tapuiasaurus\\_NT.jpg](http://en.wikipedia.org/wiki/File:Tapuiasaurus_NT.jpg).

“File:Thylacinus.jpg.” *Wikipedia, the Free Encyclopedia*. Accessed November 5, 2013. <http://en.wikipedia.org/wiki/File:Thylacinus.jpg>.

“File:TriceratopsTyrrellMuseum1.jpg.” *Simple English Wikipedia, the Free Encyclopedia*. Accessed November 7, 2013. <http://simple.wikipedia.org/wiki/File:TriceratopsTyrrellMuseum1.jpg>.

“File:Ur-painting.jpg.” *Wikipedia, the Free Encyclopedia*. Accessed November 5, 2013. <http://en.wikipedia.org/wiki/File:Ur-painting.jpg>.

“File:Zzznukupuuaffinis.jpg.” *Wikipedia, the Free Encyclopedia*, July 24, 2013. <http://en.wikipedia.org/w/index.php?title=File:Zzznukupuuaffinis.jpg&oldid=422170267>.

“File:Zzzoahucreeper.jpg.” *Wikipedia, the Free Encyclopedia*, July 24, 2013. <http://en.wikipedia.org/w/index.php?title=File:Zzzoahucreeper.jpg&oldid=422170506>.

“File:Zzzulaaihawane.jpg.” *Wikipedia, the Free Encyclopedia*, June 13, 2013. <http://en.wikipedia.org/w/index.php?title=File:Zzzulaaihawane.jpg&oldid=422170457>.

JaySo83. *English: Three-spine Stickleback (Gasterosteus Aculeatus) at the Fluvarium, St. John's, NL.*, January 5, 2011. Own work. [http://commons.wikimedia.org/wiki/File:Stickleback\\_Gasterosteus\\_aculeatus\\_.jpg](http://commons.wikimedia.org/wiki/File:Stickleback_Gasterosteus_aculeatus_.jpg).

Raynal, Pr Dr. *English: The Massive Extinctions Cut More Branchs of the Tree of Life.*, out (manuel libre et gratuit SVT 2008. Own work. [http://commons.wikimedia.org/wiki/File:Effets\\_extinctions.png](http://commons.wikimedia.org/wiki/File:Effets_extinctions.png).

Zaher, Hussam, Diego Pol, Alberto B. Carvalho, Paulo M. Nascimento, Claudio Riccomini, Peter Larson, Rubén Juárez-Valieri, Ricardo Pires-Domingues, Nelson Jorge da Silva, and Diógenes de Almeida Campos. “A Complete Skull of an Early Cretaceous Sauropod and the Evolution of Advanced Titanosaurians.” Edited by Paul Sereno. *PLoS ONE* 6, no. 2 (February 7, 2011): e16663. doi: 10.1371/journal.pone.0016663.





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