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THE *HADROPITHECUS* CONUNDRUM – SOLVED

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Archaeolemurids (*Archaeolemur* and *Hadropithecus*) are remarkable for their convergences with papionins. These giant extinct lemurs had relatively large brains, slow dental development, and postcranial adaptations for terrestrial quadrupedalism. In some ways, they were more hominin- than papionin-like. This pertains to aspects of the cranial architecture of *Hadropithecus* and dental microstructure (exceptionally thick molar enamel) of *Archaeolemur*. Striking differences in stable isotopes confirm trophic differences: *Hadropithecus* was a C4 specialist while *Archaeolemur* consumed predominantly C3 foods. We use Finite Element Analysis to evaluate their performance under loading regimes that mimicked unilateral biting with P4 and M2 at maximum gape, thus probing the significance of their craniodental differences. We test the hypothesis that *Archaeolemur* was better adapted to process large, hard objects, while *Hadropithecus* was better adapted to process greater quantities of softer, smaller items – perhaps underground storage organs of grasses. We show that the skull of *Archaeolemur* was the stronger of the two (exhibiting less stress under both loading regimes) and that *Archaeolemur* had a wider maximum gape, while mechanical and energy efficiency were consistently higher for *Hadropithecus*. Results support the hypotheses that *Hadropithecus* processed smaller food items and was less capable of withstanding high bite forces, but given the same amount of energy, could have used many more masticatory cycles than *Archaeolemur*. Our observations have implications for understanding the trophic adaptations of extinct lemurs and fossil hominins.

Keywords: *Finite Element Analysis,* Hadropithecus*,* Archaeolemur*,* Paranthropus