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Evaluating the utility of linear measurements to identify isolated tooth loci of extinct Hyracoidea

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Serially homologous elements pose an identification problem in fragmentary records, particularly those of vertebrate fossils. Examples include individual vertebrae in the vertebral column and teeth in a tooth row. Until an isolated element can be accurately attributed to a specific position within its series, multiple lines of ecological and evolutionary research cannot be conducted. However, varying levels of differentiability between loci, and varying patterns of differentiation across clades, make it impossible to develop a single set of diagnostic traits for any particular set of serial homologues, particularly mammalian molars. Here, we test the utility of a set of classification criteria for distinguishing molar tooth positions of hyraxes (Mammalia, Afrotheria, Hyracoidea), which have been considered indistinguishable in previous taxonomic studies. As part of the test we evaluate the degree to which between-locus variation is conservative in this taxon, which would strengthen the predictive power of proposed traits even in cases where species identity is unknown. Suitable tests for hypotheses of conservatism in categorical traits did not exist, to our knowledge, and we therefore explored the behavior of a previously developed metrics, Borges et al.'s δ, to assess conservatism in contrast to phylogenetic signal produced by Brownian motion. This metric shows some promise but the nature of resulting distributions makes tests difficult to interpret, indicating a line of potential future methods improvement. We used a linear morphometric characterization of shape to validate the candidate traits. In the case of hyracoid molars, relatively simple ratios of linear measurements have strong discriminatory power despite evolutionary variation in between-locus differences. Overall, new or understudied taxa are likely to have lower molar loci differentiable by their relative length and talonid vs. trigonid width.

Key words: Mammalia, Afrotheria, Hyracoidea, morphometrics, Africa, Fayum, molars, phylogenetic conservatism, inhibitory cascade.

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