

## THE APPLICATION OF IMMUNOLOGICAL METHODS TO ANALYSIS OF FOSSIL SPECIMENS

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Preservation of informative biomolecular content in fossils beyond one million years is debated. We have applied immunological methods to address this issue, because of their sensitivity and specificity, and because positive identification of antibody binding does not require intact molecules but can occur with as little as 3-5 amino acid residues. We have demonstrated that antibodies to avian alpha- and beta- keratin proteins react to fibrous material believed to be claw sheath remnant adherent to the ungual of a Cretaceous bird from Madagascar. In a second experiment we have shown that antibodies to avian beta keratins react with fibrous structures preserved with an enigmatic basal bird from Mongolia, while alpha keratin and non-relevant antisera do not. These results are consistent with what is known of the expression of these proteins in extant taxa. These experiments demonstrated the possibility that antibodies raised against modern proteins react with fossil tissues, and therefore retain antigenicity. In a second set of experiments, we sought to demonstrate that fossil specimens also retain immunogenicity, by using whole bone extracts of mammoth (minimum age, 100,000) to immunize rabbits and mice. The resulting antisera show strong reactivity to the mammoth antigen, by immunoblot, immunohistochemistry, and by ELISA, while the preimmune sera are non-reactive. In addition, when tested against whole bone extracts of various extant taxa, strength of crossreactivity indicates that some phylogenetic information may be retained in the molecular fragments preserved within these mammoth tissues.