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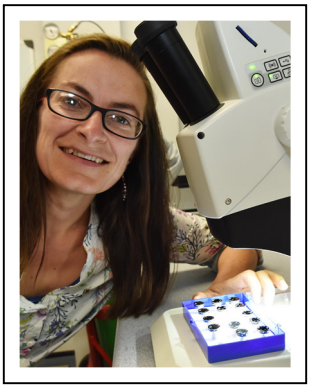

CHEMICAL AND ULTRASTRUCTURAL CHARACTERISATION OF PIGMENTED SOFT TISSUES IN FOSSIL VERTEBRATES AND INSECTS

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ABSTRACT

The emerging field of fossil colour has revolutionised palaeobiology with the discovery that the soft tissues of fossil animals can preserve evidence of pigments for up to hundreds of millions of years, allowing the first evidence-based reconstructions of original colouration of integumentary tissues such as skin, hair and feathers. Such studies can inform hypotheses regarding the evolution of communication strategies and potentially the physiology and ecology of extinct animals. Examination of fossils and of experimentally degraded soft tissues, however, shows that the morphology and chemistry of pigmented tissues can alter during the fossilisation process, precluding a direct reading of the fossil record. Here I will present a review of some of the latest advances in fossil colour research utilising electron beam technology and how insights from taphonomy – fossil preservation – can be integrated with data from other sources to provide more accurate inferences of fossil color and of the functional evolution of pigmentary coloration in animals through deep time.

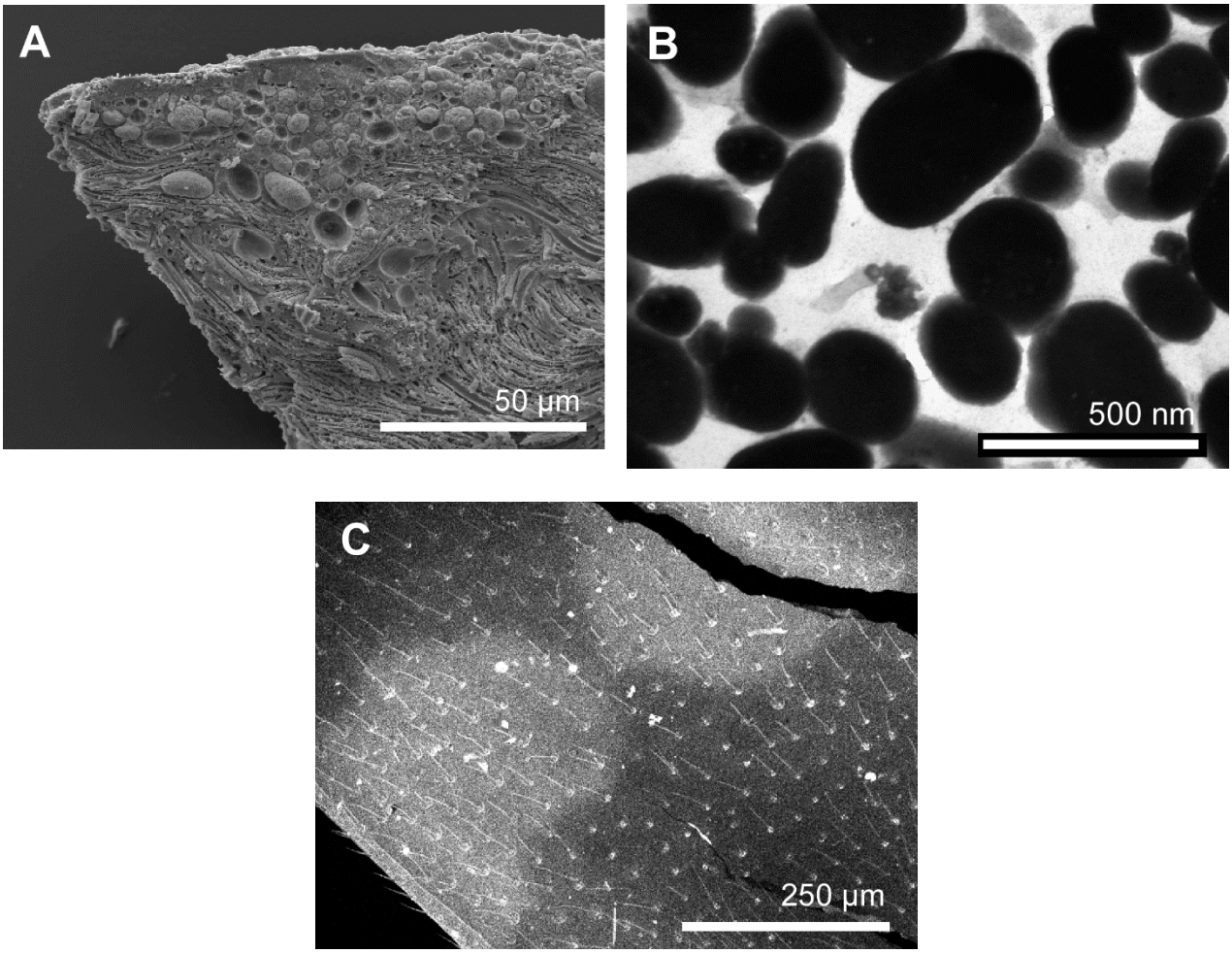

Figure 1. Analysis of pigmented animal tissues. A) Scanning electron micrograph of a fractured transverse section through the skin of a 10 million year old fossil snake showing abundant ovoid pigment cells and sinuous collagen fibres. B) Transmission electron micrograph of a stained section through the soft tissues of a 10 million year old fossil frog showing opaque melanosomes (micrometre-sized cell organelles rich in the pigment melanin). C) Electron probe microanalysis map for K in the cuticle of an experimentally degraded modern insect. The light toned band at centre indicates relatively high K-concentrations in the dark, melanin-rich band; to either side, the dark-toned bands represent relatively low K-concentrations in the light, melanin-poor regions of the cuticle.