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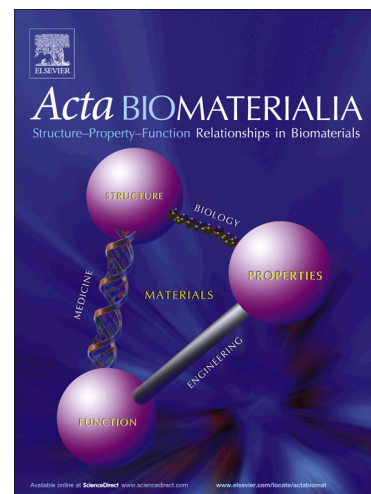
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The three-dimensional arrangement of the mineralized collagen fibers in elephant ivory and its relation to mechanical and optical properties

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ABSTRACT

Elephant tusks are composed of dentin or ivory, a hierarchical and composite biological material made of mineralized collagen fibers (MCF). The specific arrangement of the MCF is believed to be responsible for the optical and mechanical properties of the tusks. Especially the MCF organization likely contributes to the formation of the bright and dark checkerboard pattern observed on polished sections of tusks (Schreger pattern). Yet, the precise structural origin of this optical motif is still controversial. We hereby address this issue using complementary analytical methods (small and wide angle X-ray scattering, cross-polarized light microscopy and scanning electron microscopy) on elephant ivory samples and show that MCF orientation in ivory varies from the outer to the inner part of the tusk. An external cohesive layer of MCF with fiber direction perpendicular to the tusk axis wraps the mid-dentin region, where the MCF are oriented mainly along the tusk axis and arranged in plywood-like structure with fiber orientations

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