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In-Situ Atomic Force Microscopy of Bone Fracture Surfaces Reveals Collagen Fibrils Individually Coated with Mineral Particles of Varying Shape and Size[1] JOHANNES H. KINDT, GEORG E. FANTNER, PHILIPP THURNER, GEORG SCHITTER, PAUL K. HANSMA, University of California-Santa Barbara — High resolution AFM images of bovine trabecular bone fracture surfaces reveal individual fibrils coated with extrafibrillar mineral particles. Treating bone with EDTA removes the mineral particles on these fibrils, and reveals the underlying collagen structure. The mineral particles show distinctly different size and morphology in different regions. Significantly, we rarely observed bare collagen fibrils in fracture surfaces before EDTA treatment. This implies that fractures propagate between the mineral particles on one fibril, and the mineral particles on another fibril. Thus, to understand the mechanics of fracture on the molecular scale, it will be crucial to understand the molecular nature of the adhesion between the mineral particles that coat adjacent collagen fibrils, because this is the weak interface that fails during fracture.

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