Abstract

Understanding the three-dimensional (3D) organization of DNA within chromosomes is critical for interpreting gene regulation, cellular function, and long-term evolutionary change. While most ancient DNA studies focus on linear sequences, emerging evidence shows that 3-D genomic architecture can also be preserved. A recent Hi-C study of a 52,000-year-old woolly mammoth skin sample demonstrated that dehydration in permafrost created a “chromoglass” effect, stabilizing molecular structures and preserving ancient 3D genome organization.

However, over 99% of ancient DNA comes from hard tissues like bones and teeth, which are inaccessible using previous Hi-C methods. As a result, there is a need to develop methods to recover 3D DNA information from these dense, mineralized samples. Bone PaleoHi-C, a new protocol focused on extracting DNA structure from hard tissues, produces high-quality Hi-C maps from hard tissues and could greatly increase the sample size for Paleogenomic samples.