The studies of fossil hominins’ evolution and growth are of major importance in solving problems of anthropogenesis. Particularly, multilevel macro- / microstructural studies can yield new insights regarding early ontogeny of fossil hominins as well as broader issues of human evolution. Microstructural studies revealing histological pattern of the Denisova phalanx, its osteon structure and the preservation of lamellar tissue may be extremely informative in this regard. Comparison with respective patterns in modern humans may shed new light on their genetic relationship with Pleistocene hominins like the Denisovans and establish whether these hominins are as distinct from extant people in terms of ontogenetic patterns as are Neanderthals.

In 2010, the complete mitochondrial genome of a fossil hominin from Denisova Cave, Altai was sequenced on the basis of mtDNA extracted from the hand phalanx of a girl [1]. The present study of the same phalanx describes the preservation of the bone after sampling for aDNA, analyzes 3D and 2D magnified reconstructions, and makes a comparative histological assessment of the bone’s microstructural features. The X-ray microscopy we used is a nondestructive technique, which is an important advantage given the uniqueness and the fragmentary nature of the specimen: two fragments remaining after a DNA sampling were subjected to microCT examination.

The tomographic examination was conducted on ZEISS XRAYA Versa XRM-500 X-ray microscopy system, 3D and virtual slices were generated using the system’s proprietary software.

The micro CT (X-ray microscopy) of fragments of the hand phalanx of the Denisova girl has revealed a histological pattern which corresponds with the sequence of age changes in modern children. Unlike the Neanderthal children, the Denisova child displays no contrast with modern children in microscopic indicators of bone growth and development. This may indicate certain phylogenetic affinities, suggesting that the essentially modern pattern might have originated as early as the Lower Paleolithic. The distinctness of the Neanderthal growth pattern, then, may be an autapomorphy.


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Fig. 1: Fragments of the distal phalanx of the hand of a girl from Denisova Cave.

Fig. 2: Virtual cross-section of the proximal metaphysis with estimated osteon size.

Fig. 3: Virtual cross-section of the diaphysis with estimated osteon size.