

## **The phylogeographical history of the brown bear (*Ursus arctos Linnaeus*) in Northeast Eurasia**

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The bear family (Ursidae) is well studied and is widely represented in paleontological chronicles. Numerous bone remnants were used to establish the phylogeographical population evolution of bears. In this study we used the bone remains of four brown bears (*Ursus arctos*) from the paleontological and archaeological excavations of Southern Siberia: the Denisova Cave, the foothills of the Altai (Kolyvan-1), the banks of the Chik and Chumysh rivers (age 4.5-40 thousand years) and 19 modern bears of Siberia: Novosibirsk, Tomsk, Krasnoyarsk, Irkutsk, Yakutia; and the Far East: Khabarovsk.

After isolating the DNA from the ancient samples, we prepared libraries for sequencing. Libraries were enriched using hybridization with contemporary *U. arctos* biotinylated mtDNA immobilized on DynabeadsVR Streptavidin magnetic beads (Life Technologies, USA). Paired-end sequencing was performed on Illumina MiSeq.

Reference-based recovery of ancient bear mitochondrial genomes was performed using Paleomix BAM pipeline. Reads were trimmed and aligned to reference bear mitochondrial genome (GenBank NC001640), PCR duplicates were removed, base qualities were recalibrated with MapDamage, and indel regions were realigned with GATK. Contaminant reads were removed by alignment to human mitochondrial genome and mapping quality comparison using custom Python script. Consensus sequence was reconstructed in Geneious based on 75% majority consensus and manual refinement.

Population genetic analysis for 181 sequences of modern brown bears was performed using Arlequin 3.5. For phylogenetic analysis, we used mitochondrial sequences from our research and 260 previously published mitogenomes of brown and polar bears. It is established that ancient brown bears had great genetic diversity and belong to haplotypes from different migration waves. Modern bears are represented by two haplogroups, one of which is widespread throughout Eurasia, the second one is found only on the islands of Japan.

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