

# RESPIRATORY ADAPTATION TO CLIMATE IN THE UPPER PALAEOLITHIC

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As our human ancestors migrated into Eurasia they faced a considerably harsher climate, but the extent to which human cranial morphology has adapted to this climate is still debated. It remains unclear when such facial adaptations arose in human populations. Here, we explore climate-associated features of face shape in a worldwide modern human sample using 3D geometric morphometrics and a novel application of reduced rank regression. Based on these data, we assess climate adaptations in two crucial Upper Palaeolithic human fossils, Sungir and Mladeč, associated with a boreal-to-temperate climate. We found several aspects of facial shape, especially the relative dimensions of the external nose, internal nose and maxillary sinuses, that are strongly associated with temperature and humidity, even after accounting for autocorrelation due to geographical proximity of populations. For these features, both fossils revealed adaptations to a dry environment, with Sungir being strongly associated with cold temperatures and Mladeč with warm-to-hot temperatures. These results suggest relatively quick adaptive rates of facial morphology in Upper Palaeolithic Europe.