

AS SOLID AS A ROCK – THE PETROUS BONE AS A SOURCE OF DNA FOR THE COMPARISON OF CE- AND MPS-BASED FORENSIC IDENTIFICATION OF CHALLENGING CRANIAL BONES

Galina Kulstein¹, Thorsten Hadrys², Keith Elliott³, Miro Vranes⁴ and Peter Wiegand¹

¹ Institute of Legal Medicine, DNA department, University Hospital of Ulm

² Institute of Forensic Sciences, DNA department, Bavarian State Criminal Police Office

³ QIAGEN Ltd, Skelton House

⁴ QIAGEN GmbH

Short tandem repeat (STR) typing from skeletal remains is a very challenging task. Numerous abiotic (temperature and humidity at provenance and storage period) and biotic (e.g. microorganisms) factors can impair the analysis either by degradation or contamination of endogenous DNA, or by inhibition of the amplification. Therefore, sample selection is a critical step. Generally, dense and compact bones are known to preserve DNA better. Several studies already proved that femora and teeth have high DNA typing success rates. Unfortunately, these elements are not present in all cases involving skeletal remains. Processing partial or singular skeletal elements, it is favorable to select bone areas where DNA preservation is comparably higher. Especially cranial bones (that are composed of multiple parts) are often accidentally discovered during criminal investigations. In this examination, we evaluated the potential of the petrous bone for human identification of skeletal remains in forensic case work. Material from different sections of eight unknown cranial bones and – where available – additionally other skeletal elements, collected at the DNA department of the Institute of Legal Medicine in Ulm, Germany from 2010 to 2017 were processed with an optimized DNA extraction and STR typing strategy and compared to massively parallel sequencing (MPS) analysis. The presented strategy utilizes the Investigator Quantiplex Pro Kit for quantification and the Investigator ESSplex SE QS for a highly sensitive amplification. The results highlight that STR typing from the petrous bones leads to reportable profiles in all individuals; even in cases where the analysis of the parietal bone failed. The comparison of capillary electrophoresis (CE) typing to MPS analysis shows that MPS has the potential to analyze degraded human remains. Further, the analysis of skeletal remains could benefit from the simultaneous detection of multiple DNA markers including biogeographic- and phenotypic-related single nucleotide polymorphisms (SNPs). This additional information can be used to narrow down the assignment of potential missing persons to skeletal remains making it possible for criminal investigations to evolve from the “passive comparison” into the “active search” stage.