Ancient DNA from the skeletons of Roopkund Lake reveals migrants of Mediterranean origin in South Asia


Background and Aims

The high-altitude Roopkund Lake—situated over 5000 meters above sea level in the Himalayas—is home to the skeletons of several hundred ancient individuals, originally thought to have died during a massive hail storm. We seek to shed light on the origin of the skeletons of Roopkund Lake using ancient DNA and isotopic analysis.

Ancient DNA Data Generation

The Roopkund skeletons were deposited over the course of more than 1000 years (left). Roopkund_A individuals date to around 800 calAD (although they may not have been deposited during a single event), while Roopkund_B and Roopkund_C individuals date to around 1800 calAD. Error bars indicate the 95.4% confidence interval. Stable isotope analysis (right) shows a correlation between dietary practices and genetic clustering.

PCA Reveals Three Distinct Clusters

The Roopkund individuals cluster into three distinct groups when projected onto PCA plots that highlight their South Asian (top) and West Eurasian-related ancestry (bottom). We name these clusters Roopkund_A, Roopkund_B, and Roopkund_C.

The Roopkund_B clusters with individuals with ancestry from present-day Greece and Crete.

The single Roopkund_C individual falls in a position that is consistent with having East or Southeast Asian ancestry.

Conclusions

We identify multiple genetically and isotopically distinct groups, refuting previous suggestions that the skeletons of Roopkund Lake were deposited during a single, catastrophic event.

- The Roopkund_A group dates to around 800 AD and is of broadly South Asian ancestry, although we observe significant heterogeneity in genetic ancestry and dietary practices among individuals in this group.
- The Roopkund_B group dates to around 1800 AD and is of Eastern Mediterranean ancestry, showing specific affinity to present-day populations from Greece and Crete.
- The Roopkund_C individual dates to around 1800 AD, and is of Southeast Asian ancestry.
- Mitochondrial and Y-chromosome haplogroups (not shown) are consistent with these findings.
- Morphological analyses (not shown) are also consistent with the observation of multiple distinct groups.
- We detected no genetically related individuals (3rd degree or closer), and find that the two main groups are composed of both male and female individuals of a variety of ages.

References