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Dental Evidence from Mugharet el'Aliya, Morocco, and the Aterian

Carolin Röding^{1,2}, Sireen El Zaatari^{1,2}, Fernando V. Ramirez Rozzi³, Chris Stringer⁴, M. Loring Burgess⁵, Rodrigo S. Lacruz⁶, Katerina Harvati^{1,2,7}

1 - Paleoanthropology, Senckenberg Centre for Human Evolution and Palaeoenvironment, Eberhard Karls University of Tübingen, Tübingen, Germany · 2 - Institute for Archaeological Sciences, Eberhard Karls University of Tübingen, Tübingen, Germany · 3 - Muséum national d'Histoire naturelle, CNRS, Université de Paris, Musée de l'Homme, Paris, France · 4 - Centre for Human Evolution Research, The Natural History Museum, London, UK · 5- Peabody Museum of Archaeology and Ethnology, Harvard University, Cambridge, MA, USA · 6 - Department of Molecular Pathobiology, New York University College of Dentistry, New York, NY, USA · 7 - DFG Centre of Advanced Studies 'Words, Bones, Genes, Tools', Eberhard Karls University of Tübingen, Tübingen, Germany

The view of the Aterian lithic industry from Northwest Africa has changed drastically over the last decades. It has shifted from an industry supposedly associated with a Neanderthal-like population producing a delayed MSA between 40-20 ka to that of early *Homo sapiens* producing an MSA between ca. 145-20 ka, that also included features like personal ornaments and potentially overlapped with an earlier MSA now associated with the earliest known members of the *H. sapiens* lineage [e.g., 1-2]. Furthermore, Aterian skeletal remains are characterized by a mix of derived and archaic features, which motivate ongoing investigations into the origin of their archaic morphology for understanding evolutionary processes underlying modern human origins in the region. A recent reanalysis of the maxillary fragment from Mugharet el'Aliya, Morocco, showed that size played a significant role in the expression of archaic-like morphology, which had resulted in previous assignments of this specimen to the Neanderthal lineage [3]. Here, we explore the role of size on the Aterian dental morphology and growth, with special emphasis on the teeth from Mugharet el'Aliya.

Mugharet el'Aliya is a cave site located on the Moroccan Atlantic coast. A total of 6 fossil teeth have been found at the site since the 1930s. Three of these are associated with the Aterian layers of the site dated to ca. 60-35 ka [4] and available for our study: the so far poorly studied upper left permanent canine and third premolar as well as the so far undescribed fourth premolar. Casts of the upper canine were made to analyze perikymata counts per decile in this individual compared to a sample of Neanderthals, *Homo heidelbergensis*, and *Homo sapiens*. In addition, all three teeth were integrated into a comparative framework comprising data from CT scans as well as published metric and non-metric data of Neanderthals and early and later *Homo sapiens*, including three other Aterian teeth from two individuals (Contrebandiers T5, Dar es-Soltan II – H6). The toolkit of landmark-based geometric morphometrics was used to study the internal morphology of the enamel-dentine junction in all three tooth types. Multivariate statistics were applied to Procrustes superimposed coordinates derived from these three datasets. Summary statistics were calculated based on the metric and non-metric datasets.

As hypothesized, size is the main factor aligning Mugharet el'Aliya with Neanderthals and Middle Pleistocene groups. The dental metrics of Mugharet el'Aliya and the other Aterian teeth show high levels of megadonty similar to our Neanderthal sample from Krapina and our Middle Pleistocene samples. Dental non-metrics do not clearly distinguish between groups in our sample. However, Perikymata distribution in key regions of the upper canine of Mugharet el'Aliya showed tendencies toward a *H. sapiens* like growth pattern, falling outside the Neanderthal variation of our sample. Further, Mugharet el'Aliya shows a simplified crown morphology in all three teeth that is more similar to the dental morphology of *Homo sapiens* than to that of Neanderthals or Middle Pleistocene individuals. The enamel-dentine junction morphology of Mugharet el'Aliya, especially of its upper third and fourth premolar, aligns best with our *Homo sapiens* sample and is unlike any Neanderthal individual in our sample. The other Aterian individuals included in this study show a more intermediate enamel-dentine junction morphology, which is most similar to our early *Homo sapiens* sample.

Thereby, our results add further to the growing evidence connecting cranio-dental morphology from the Northwest African Middle Stone Age and western Asia, especially Qafzeh and Skhul [e.g., 5]. Furthermore, Mugharet el'Aliya adds to our knowledge about dental morphology within the Aterian fossil record, which spans an important time period in modern human evolution.