Preface

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Neandertal studies are undoubtedly critical to understanding the human essence. Neandertals are our closest relatives in the evolutionary tree. Their lineage diverged from that of modern human ancestors about half a million years ago. The length of this separation was not enough for reproductive incompatibility to develop between the groups, but it resulted in the emergence of anatomical differences that surpass all the variability observed between living populations of our species. Along different pathways, the two lineages independently evolved large brains. Some degree of parallelism affected other aspects of their anatomy as well. Both developed very distinctive features. This combination of similarities and differences has often made Neandertals difficult to understand both biologically and behaviorally. The passion surrounding the scientific debates on these issues come as no surprise.

This particular situation and a long and rich record of discoveries in Europe and in the Levant have naturally caused Neandertals to be the most analyzed fossil hominins. Virtually all possible methods of investigation in the field of palaeoanthropology have been applied to Neandertals and, when a new technique emerges, it is almost inevitably first adjusted on Neandertal material before being used to investigate other fossil hominin groups.

The publication of "The Scladina I-4A Juvenile Neandertal" does not simply provide us with an exhaustive description of unpublished fossil remains. Like some previous monographic publications dedicated to specific sets of fossil remains, it offers a remarkable illustration of the current available techniques at a given stage of development of the discipline. The impressive effort taken to analyze the fragmentary remains of an eight-year-old Neandertal, who lived and died some 87,000 years ago in the Meuse Valley, have benefited from the spectacular methodological advances witnessed in the field of palaeoanthropology over the last two decades. Following two other volumes, one dedicated to the sedimentary filling of Scladina and its palaeoenvironment and the other to the archaeological material unearthed in the cave, this volume will therefore stand as a main reference along the continuous and disparate flow of Neandertal studies that have been produced since the first discoveries of these archaic humans in the middle of the nineteenth century.

The study of the Scladina Neandertal juvenile starts with the detailed analysis of its geological and archaeological context. Taphonomy has become a key issue to understand the occurrence of fossil hominins in archaeological sites. Specifically, the anthropogenic nature of their deposition cannot be taken for granted anymore; site formation and carnivore activities must be now seriously investigated. In Scladina Cave, the remains of a deceased child including at least the skull and the mandible, but possibly some other parts of the body, were dispersed inside a karstic cavity in relation with the formation of a gully, ending up in three different sedimentary environments. How these fossils entered the cave is still purely speculative. However, although fragmented, the bones were little weathered and are remarkably well preserved.

A large portion of the analysis of this fossil hominin was conducted at the Department of Human Evolution of the Max-Planck Institute for Evolutionary Anthropology in Leipzig, where the remains were loaned on several occasions and were CT-scanned. Dr. Michel Toussaint was hosted in the department for several periods of time, during which access to the fossil material by various specialists was made possible and intense collaborative works could take place. Several forms of sampling, including the preparation of histological thin sections, were also conducted. The well-preserved and rather complete dentition of the specimen allowed a detailed analysis of the dental tissues, from a quantitative and non-quantitative point of view. Imagery techniques were largely exploited for the visualization of internal structures and for the study of the dental surface microwear.

The sections of this volume where geometric-morphometrics were implemented to analyze shapes and forms are quite significant of the evolution of the field. They complement the detailed anatomical descriptions and allow the quantitative assessment of subtle morphological variations. This is particularly spectacular when dealing with fine internal structures such at the enamel-dentine junction in the dental crown. These mathematical tools also allow the Scladina individual to be repositioned in the developmental context of Neandertal mandibles, emphasizing that Neandertal juveniles seem more advanced along their growth trajectory than modern human juveniles of similar dental age.

Key aspects of the results obtained on the Scladina Neandertal relate to its immature nature. Changes in life history patterns and developmental rates played a central role in the establishment of the human niche among hominoids. Approaches based on life history theory have initially suggested that the human developmental pattern emerged at an early stage of the genus *Homo* evolution. However, empirical data provided by the fossil record brought no support to this notion. *Homo erectus* and most likely some later Pleistocene hominin forms did not display a modern developmental pattern. Specifically regarding Neandertals, the analysis of the Scladina juvenile's dental tissues has been pivotal in highlighting differences with modern humans. Enamel and dentine microstructures of this immature Neandertal demonstrate a clear discrepancy between its calendar age at death and a developmental age that could be estimated on modern standards for dental eruption. These results support the hypothesis of a faster dental and/or somatic development in Neandertals.

The Scladina juvenile was also one of the first Neandertals from which ancient DNA was extracted and sequenced, at a stage of development of palaeogenetics when only fragments of mitochondrial DNA could be analyzed.

Another pioneering study that has been conducted at Scladina addresses the stable isotopes of N and C in preserved organic molecules of the bony structure. The palaeodietary reconstruction it allowed confirms the importance of the consumption of open environment herbivores for Neandertals. This diet could have been driven by a choice; alternatively, other sources of game could have been difficult to access at the time the Scladina Child lived.

The Scladina hominin provides us with a wealth of information for Neandertals during a time period — the early Weichselian — that to date only yielded a limited fossil record in Western Europe. It provides invaluable information on the individual Neandertal development and shows that many of the distinctive features of the group are already present at a juvenile stage.

The events that allow the preservation of fossil hominins such as those from Scladina are extraordinary. The remains of a rare mammal of the Pleistocene landscape have miraculously

survived in the sediment of a cave for tens of millennia and unexpectedly escaped total oblivion. Facing the material evidence of extinct forms of hominins always provokes deep emotions in anyone perceiving their exceptional nature. The never-ending interest of the public for the Palaeolithic world is one of the most obvious expressions of this fascination. There is however a high risk of betraying the rich message that fossil hominins can deliver to us by turning them into inaccessible relics, overprotected in museum showcases. A long tradition of storytelling surrounds Neandertal remains. Some might be satisfied with it, but the truth is that only hard work by specialists can unveil some snapshots of these lost existences. The study of a fossil hominin can never be considered finished, as new methods of investigation constantly appear in the field of palaeoanthropology. It is therefore of the utmost importance to warrant access to the fossil material for the scientists. Still there are countless examples of restriction on this access. In sharp contrast, the discoverers and curators of the Scladina juvenile Neandertal showed exemplar flexibility and openness in supporting all possible studies of these precious remains. Their reward is a monograph that provides an impressive variety of results and will remain as a model of its kind.

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