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Taphonomic analysis of the Neanderthal specimens from Neander Valley

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The discovery of the Neanderthal-type specimen in the German cave of Kleine Feldhofer Grotte in 1856 initially consisted only of the cranial calotte and 15 postcranial bones, identified as Neanderthal 1. Almost 150 years later, in 1997, R.W.S. and J. Thissen rediscovered the cave sediments and subsequent excavations revealed a suite of faunal remains, lithic artefacts and new human bone fragments. Among these findings were bones belonging to the original Neanderthal type specimen and another individual, Neanderthal 2 [1]. In 2006, using the ZooMS technique [2] 18 additional human bones were identified. Our recent study contributed further to this account, uncovering 14 new human fragments among the faunal remains.

Since the mid-20th century, cut marks on the bones of the Neanderthal 1 have been repeatedly discussed. Both recent cut marks from the moulding in the museum and Paleolithic cut marks were published [3-4]. A significant issue in these examinations is the bone surface contamination with varnish and molding materials. The 19th-century bone material underwent numerous casting procedures (e.g., gypsum wedge form method, condensation, or additive cross-linked silicone). It has been documented that a minimum of 9 casts were crafted for the calotte, with a similar number likely for the postcranial bones [4]. The aim of this study is to conduct an updated taphonomic analysis of the entire collection, comprising 112 human bone fragments attributed to Neanderthals 1 and 2. This analysis seeks to clarify the origin of these marks and also, the origin of the accumulation.

The microscopic examination of the bone surfaces unequivocally identified scratches attributed to the casting processes applied to bones recovered during the 19th century. Additionally, materials retrieved from recent excavations exhibit signs of modern trampling, likely associated with quarry activities and subsequent deposition in the secondary location.

In addition to these scratches, clusters of linear marks were identified on 11 human bones. Among these, two distinct patterns can be distinguished. On one hand, the material recovered in the new excavations presents linear marks characterized by partially exfoliated flakes with a color distinct from the surrounding surface, indicating excavation damage. However, in certain marks, manganese dendrite formations are consistently observed on their surface but also on the unaltered surrounding surface. This suggests a potentially older age for these scratches. Yet, upon examining other materials recovered during the 1990s excavation season, we found that many pottery items from the 19th century also exhibit the same dendroid mineral pattern. Hence, it is likely that the manganese deposition occurred between the discovery of the Neanderthal type specimen and the subsequent 1990s excavation, during its secondary placement. On the contrary, in the cranial vault of the Neanderthal 1, recovered during the 19th century, these V-shaped lines are similar in color to the bone surface, complicating interpretation. Microscopic analysis of these marks revealed that they interrupt and alter the dendritic formation. Consequently, these cut marks postdate the deposition of dendrites, suggesting a modern origin. The aged appearance of these marks is likely due to the varnishing that these bones underwent. We infer that some of these marks were originated during casting, while those in the sagittal profile may result from the use of the craniograph, as evidenced in other fossil cranial remains [5].

Finally, over 130 bone fractures were analyzed. The long bones show a fracture pattern dominated by transverse fractures along the axis, complete circumferences, and fracture edges with right angles and jagged surfaces. There are no signs of carnivore or human activity on the skeletons, except for quarrying and casting activities. These results indicate a rapid burial of the bodies, which could be compatible with funerary practices.

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