

Hyoid bone analysis supports hypothesis of complex language in Neanderthals

December 19 2013, by Lucia Mancini

High-resolution 3D analyses of a fossilized hyoid bone support the hypothesis that the Neanderthals communicated with the use of complex language. The study was published yesterday in *Plos One*.

Could Neanderthals talk? The latest X-ray analysis conducted at the Elettra Sincrotrone Trieste research center (Italy) on the hyoid bone of a Neanderthal Man found in 1989 on the archaeological site of Kebara (Israel), strongly supports this hypothesis. The paper was published in the international journal Plos One, and presents the results of a comparison between the biomechanical properties of the Kebara hyoid and those of the same bone in *Homo sapiens*. The study was conducted by an international research team with members from Elettra, the University of Chieti and ICTP (Unesco) in Italy, the University of New England and of New South Wales in Australia, and the University of Toronto in Canada.

Scholars dealing with the question of complex language and its evolution, already had focused their attention on the hyoid bone. This is the only bone of the vocal tract and therefore the only part that can fossilize. The hyoid provides support to the larynx and serves as anchor for the tongue and other muscles needed - at least in *Homo sapiens* - in phonation. It is already known, from the study of external morphology, that the hyoid bones of *Homo neanderthalensis* and modern man don't differ significantly, as they have a different shape from that of other primates such as chimpanzees. "This observation," says Ruggero D'Anastasio, paleontologist at the University of Chieti, "while being

compatible with the use of language by this species of Homo that lived between two hundred and thirty thousand years ago, is in no way sufficient. To be able to say something about the function of the hyoid bone, it was crucial to analyze its internal microstructure, which remodels in response to the mechanical stress to which the bone is subjected."

"At Elettra - explains Lucia Mancini, physicist and expert in X-ray imaging techniques - we have analyzed the hyoid of Kebara and those of numerous Homo sapiens, using microtomography technique, which can provide, in a non-invasive way, a virtual reconstruction in three dimensions, showing the histological characteristics of the bone (trabecular thickness and pattern distribution of the vascular channels) with a resolution not achievable with conventional CAT. From these reconstructions our Australian and Canadian colleagues have also done simulations with the so-called "finite element analysis", originally designed to study materials in the aerospace and nuclear industry, useful to evaluate the biomechanical response of the bone, as a result of external stress."

The results obtained with X-ray microtomography have confirmed that the internal microstructure of the hyoid bone from Kebara is similar to that of the hyoid of modern humans and that, in all the samples, the histological structure is typical of a bone subjected to intense and constant metabolic activity (such as language). Comparisons based on [finite element analysis](#) show significant similarities in the micro-biomechanical behavior.

"Although we plan to analyze other hyoids to further increase the significance of the data," says D' Anastasio, "I believe that this work represents a decisive step forward supporting the hypothesis that the Neanderthals were using complex language. Our results confirm in fact that the hyoid [bone](#) of the two species had the same type of

biomechanical usage. That this also corresponds to the same function—that is speech—it really seems the most reasonable conclusion. Our results, added to other evidence coming from paleontology, archaeology and paleogenetics, goes in the same direction. The use of pigments, the subdivision of residential areas into zones, the use of animal remains (for instance feathers) as personal ornament and other behaviors that can be interpreted as forms of complex communication, were attributed before only to Homo sapiens, but recently they have been confirmed also for the Neanderthals. All this adds up to conclude that our ancestors could actually talk."

"Maybe the Neanderthals could also sing and dance to the sound of music," adds Claudio Tuniz, physicist Claudio Tuniz of the Abdus Salam International Centre for Theoretical Physics in Trieste "as suggested by our recent studies on the flute made from the femur of a bear, found in Slovenia on a site that was frequented by Neanderthals 60 millennia ago."

More information: "Micro-Biomechanics of the Kebara 2 Hyoid and Its Implications for Speech in Neanderthals". Authors: R. D'Anastasio, S. Wroe, C. Tuniz, L. Mancini, D. T. Cesana, D. Dreossi, M. Ravichandiran, M. Attard, W. C. H. Parr, A. Agur, L. Capasso. *Plos One*, 18 December 2013 [DOI: 10.1371/journal.pone.0082261](https://doi.org/10.1371/journal.pone.0082261)

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