Improved noninvasive microstructural analysis of fossil tissues by means of SR-microtomography

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State of the art in paleobiology foresees the use of nondestructive investigative approaches on the usually scarce and fragmentary fossil record. X-ray microtomography (µCT) allows the extraction, at a high spatial resolution (tens of microns), of hidden structural information from dental and bony fossil specimens. In particular, synchrotron radiation microtomography provides a unique source of monochromatic and high photon flux x-ray beam which, in comparison to the commercially and industrially available µCTs equipments, guarantees higher signal-to-noise ratio imaging.

While µCT applications in paleontology and (paleo)biology are still limited, in order to detail large-size fossil specimens at high spatial resolution (<50µm), we have experienced the ESRF ID17 medical beamline within two related research lines.

The first line concerns the quantitative assessment of the inner normal/abnormal bone architecture for the reconstruction of postural/locomotory patterns in fossil taxa (Figure 1a). This innovative approach bases on the dynamic interplay between the cortical and trabecular bone structures and their biomechanical environment, where normal bone mostly builds and remodels in response to mechanical demands.

The second research line is designed to detail major dental structural features (Figure 1b) such as, among the others, the enamel thickness topographic variation. This represents a key variable in (paleo)primatology and (paleo)anthropology because of its value as indicator of dietary habits and in taxonomic assessment and phylogenetic reconstructions.

The methodological issue of the degree of repetitivity and replicability of the measurements with respect to the conventional radiographic and histological approaches is also considered.

Through the example of the ongoing "*The-Neanderthal-Tools*" European project, the relevance of this kind of methodology for the documentation, analysis, and safeguard of the (paleo)biocultural record will be illustrated.

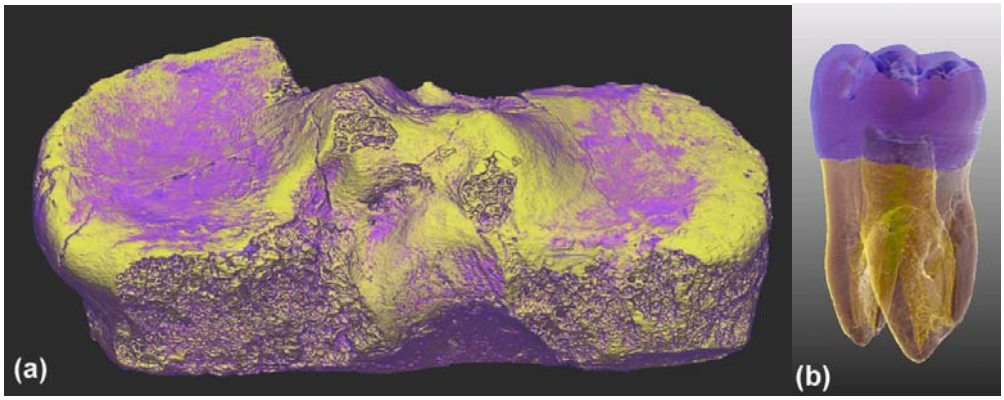

Figure1: 3D reconstructions of (a) a tibia of a Neanderthal from La Ferrassie, France and (b) a molar of a Neanderthal from La Chaise de Vouthon, France