Synchrotron Investigations of Fossil Hominin Dental Structure and Development

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Recent non-destructive X-ray synchrotron microtomographic studies have revealed internal tooth structure, including dental microstructure, with high fidelity (Tafforeau et al. 2006; Tafforeau and Smith in press). Anthropological applications include investigations of enamel thickness and root morphology in a number of human and primate fossils, as well as developmental features in fossil hominin enamel and dentine (Smith et al. 2007; Tafforeau and Smith in press). These studies have provided the earliest evidence of a modern human life history in a 160,000 year old early *Homo sapiens* from Morocco (Smith et al. 2007). Here we review recent anthropological applications of synchrotron microtomography, including on-going experiments on additional early *Homo sapiens* and Neanderthal juveniles. One of the most powerful uses of this technique is the non-destructive detection of the neonatal (birth) line, in addition to the incremental long-period line periodicity. The lack of these parameters in previous studies has led to broad estimations of developmental timing and age at death in other fossil hominins. Given the recent finding of a rapid developmental profile in a juvenile Belgian Neanderthal (Smith et al. in press), synchrotron imaging allows accurate non-destructive assessment of multiple Neanderthals, leading to clearer resolution of the origins of modern human life history and resolution of the long-standing debate over developmental differences between Neanderthals and our own species.

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