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Palaeontology: Highlights of X-ray computed tomography at the synchrotrons

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Fossils remains of animals that existed in periods such as the Permian, Triassic and Jurassic eras have been discovered in Africa. There is also an extensive collection of human ancestral remains from a few million years ago or less that have been found such as Australopithecus Sediba, Turkana Boy (*Homo ergaster*), Zinjathropus (*Parantropus boisei*) and Sahelanthropus tchadensis which have added to our understanding of the history of life on earth. The discovery of the earliest hominid remains on our continent has led to the designation of Africa as “the cradle of mankind”. X-ray computed tomography (CT) provides a useful way of studying fossil materials which are rare and sometimes fragile. It allows researchers to observe the internal structures and take measurements that can be used to make useful comparisons and answer questions on subjects such as locomotion and possible diets. There are now many laboratory based CT scanners available from which resolutions in the micrometre and nanometre ranges can be obtained depending on the size of the specimen. However, laboratory based scanners have limitations on the X-ray flux and energy which can be generated. This has led to the use of synchrotron facilities to study some of the fossil remains. We present the highlights of CT scanning of African fossils at synchrotron facilities and the future of 3D computed tomography. We also present an investigation into the nature of some of the high density inclusions which are occasionally observed after a scan of a fossil which can result in a loss of contrast. We have determined the nature of the high density materials as iron and manganese in one such sample using X-ray fluorescence (XRF). Complementary techniques such as X-ray diffraction (XRD) and Mössbauer spectroscopy have also been used to further characterize these inclusions. This information may be useful when some of the specimens have to be taken to a synchrotron for scanning as is sometimes the case.

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