ESRF	**Experiment title:** Minute Microstructure of Dinosaur Bones	**Experiment number**: SC1225
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1. Introduction

Dinosaur bones of *Brachiosaurus brancai* and *Barosaurus africanus* are to be investigated. The skeletons were excavated in Tendaguru, Tanzania, East Africa by a group from the German Friedrich Wilhelm University of Berlin during the period 1909 – 1913 /Janensch 1914/. The reconstructed skeletons today are on display in the Museum für Naturkunde in Berlin /Janensch 1935, 1950/.

Brachiosaurus brancai and the *Barosaurus africanus* are sauropods belonging to the saurischia /Rensberger 2000/ which were 'a successful group of dinosaurs during the Jurassic and Cretaceous periods ' /Buffetaut et al. 2000/.

The Brachiosaurus brancai reached a height of about 12 m. Its mass estimated from three-dimensional stereophotogrammetry as well as from a newly developed laser scanning technique the body mass of Brachiosaurus brancai was determined to 74.4 tons. The volume distribution indicates that nearly 90% of the mass of the Braciosaurus brancai was concentrated in its neck and particularly in its thorax /Gunga et al. 1999/. In contrast to the *B.brancai* the *B.africanus* had a small neck volume, its body weight was concentrated in the tail and hindlimbs /Gunga et al. 1999/. This indicates that the load impact on the lower cervical vertebrae and fore-/hindlimbs for *B.brancai* and *B.africanus* was essentially different. In both the cases the body mass was estimated to values that are not reached by any terrestrial animals of modern times. This rises an ovious curiosity about the mechanical performance of their skeletons. The mechanical adaptation for gigantism is sought in the internal bone structure.

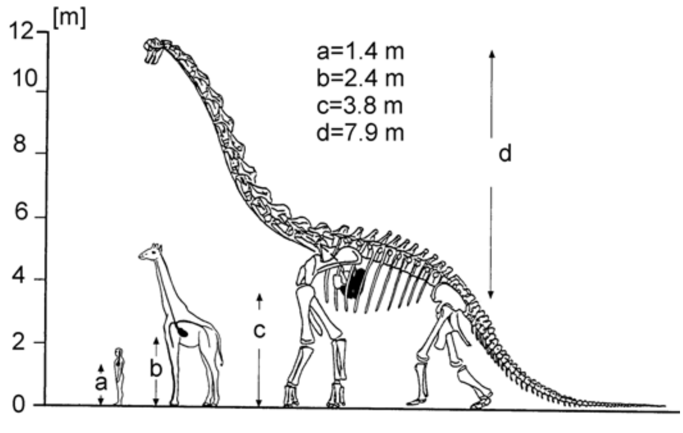
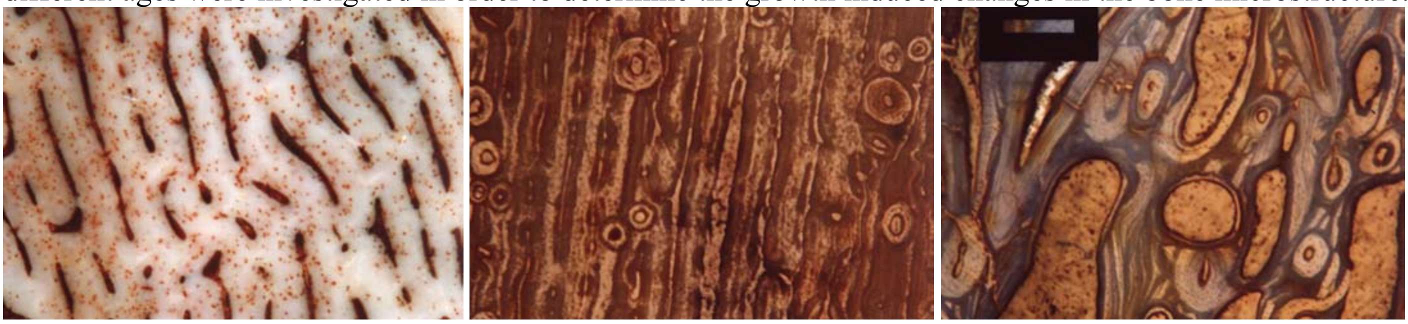


Fig. 1: ***Schematic view of the major hydrostatic distances acting on the heart and circulatory system in humans, giraffe and Brachiosaurus brancai, /Gunga et al. 1999/***

In general, the histology of bones of dinosaurs resembles rather the bone histology of mammals or the bone histology of birds, depending on the dinosaur lineage, than modern reptiles. The bones of dinosaurs show an irregular canalicular structure and typical for mammals and birds histological structures /Rensberger et al. 2000/. Differences in the canalicular as well as in the lamellar organisation structure are probably linked to differences in the processes of bone formation, growth and maintenance /de Ricqles et al. 1991/. The tissue in the primary bone of sauropods has been suggested not to have visible lamellae of primary osteons /Currey 1962/. However, so far the finer bone structure of dinosaurs has been poorly documented /Rensberger et al. 2000/ and especially bone structure as a function of evolution and load is not known.

2. Experiment and Results

Fossil bones of the both species were subjected to microtomography at ID22. Measurements were performed both with absorption and phase contrast at the energy of 16keV. Samples from different regions along the diameter of bone cross section at long bone middle shaft were studied in order to account for the differences in the enosteal, the transitional and the periosteal region (Fig.2). Also samples of animals that died at different ages were investigated in order to determine the growth induced changes in the bone microstructure.



a) perisoteal region b) transitional region c) endosteal region

Fig. 2: Typical bone structures found in Barosaurus africanus along a radius of cross secioned long bone a) the outer part, newly deposited bone, b) osteons, remodelled bone structure, c) trabecular-compact bone interference

The results of the experiments reveal the 3D - distribution of hydroxyapatite and diagenetic minerals in the fossil bones (fig. 3b, fig3c). Also 3D – distribution of the lacunae, voids housing bone cells during animals life, in the bones could be visualized (fig.3a). Further data analyses are in progress.

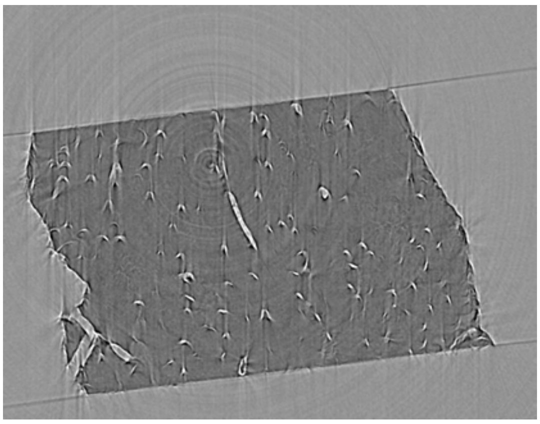
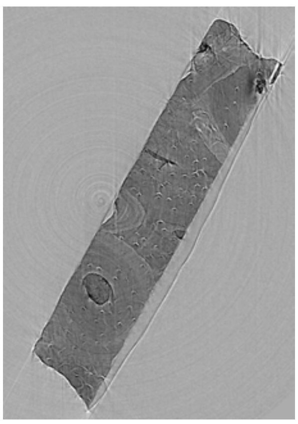
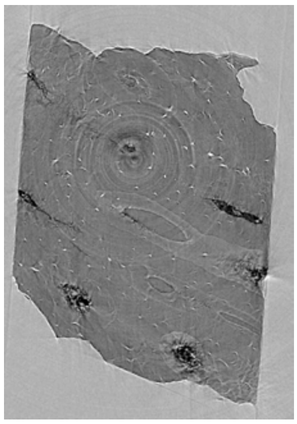
a)  b)  c) 

Fig. 3: 2D slices of recontstructed data: a) bovine bone b) *B.africanus*, transitional region c) *B.brancai* periosteal region

3. References

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