s7'.m2.p3 The Micro-SAXS Facility at ESRF Beamline ID22- Monitoring the Process of Bone Growth in Model Biological Systems. M. Drakopoulos1, T.J. Wess2, A.P. Hammersley1, A. Snigirev1, I. Snigireva1, P.M. Hocking3 *1) Department of Biological Sciences University of Stirling, Scotland, 2) ESRF Grenoble, 6, rue Jules Horowitz, France, 3) IAPGR Roslin, Scotland.*
Keywords: synchrotron, instrumentation, microdiffraction.

The new ESRF micro-SAXS facility at beamline ID22 currently achieves a resolution of $q = 0.05\ nm^{-1}$ ($q = 2\pi/d$) with possibility for improvement. The spatial resolution is about 1 µm. Figure 1 shows the diffraction from oriented collagen fibers and demonstrates the instrumental resolution obtained until now.

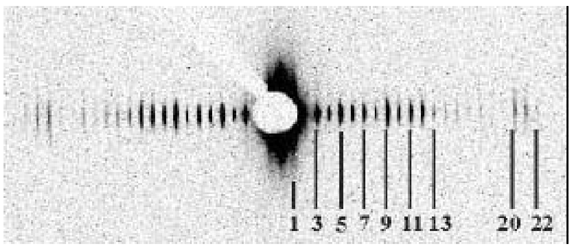

Figure 1: µ-SAXS from oriented collagen fibers (rat-tail tendon), diffraction orders 1 through 22 visible; raw-data, 30 s exposure

Bone is a composite material characterized by its strength and resistance to compression. In bones and other calcified tissues, a network of collagen fibrils is embedded in a matrix of hydroxyapatite crystals deposited and grown within and between collagen fibrils [1]. The basis for this process remains unresolved. The formation of plate like or needle crystals of hydroxyapatite is thought to derive from interaction within the collagen fibrils. In some calcifying tissues, the process of mineralisation appears as a growing front, which moves along the tendon producing a fully calcified tendon over a number of days.

The thickness and shape of the first mineral crystals from growing edge of mineral over the first 30 microns of calcified tissue could be determined. Results indicate that the overall crystal thickness of hydroxyapatite crystals related to the overall age of the bird more than the position from the edge of mineralisation. The shape of detectable crystallites also tended to be similar over the distance examined indicating that bone growth is by the thickening and extension of plate like structures as opposed to the fusion of needle like structures to form plates.

The low divergent micro-beams were formed using Fresnel-Zone plates and parabolic compound refractive lenses[2] obtaining a flux of $5 \cdot 10^{10}$ photons per second.

[1] Fratzl P. et al., J. Bone and Mineral Research (1992) **3** 329-334.
[2] B. Lengeler, C. Schroer, J. Tümmler, B. Benner, M. Richwin, A. Snigirev, I Snigireva, M. Drakopoulos, J. Sync. Rad. 6 (1999) 1153-1167.