ERC Starting Tilman Grünewald (start 01/07/2022; 5 years)
Fresnel/ISM

TexTOM:
X-ray texture tomography as a tool to enable, multi-scale, in-situ imaging of the enthesis, a biological hinge between bone and tendon
La « texture tomography » par rayons X comme outil permettant l'imagerie multi-échelle et in-situ de l'enthèse, connexion biologique entre l'os et le tendon

Short project summary:
Biological materials exhibit outstanding mechanical properties and combine seemingly contradictory features like strength and toughness. This is caused by the intricate, hierarchical organization of these materials on the nanostructural and crystal structural level, the so-called crystallographic texture. The determination of the crystallographic texture and the local nanostructure in 3D, while retaining a large field of view is an unsolved problem until now.
In the framework of the ERC Starting grant project "TexTOM", this problem is going to be solved by introducing texture tomography, a 3D imaging technique based on X-ray diffraction and employed a synchrotron radiation source, schematically sketched in Fig 1.
With this technique, it will be possible to understand the structure of the enthesis (Fig 2), the biological connection between bone and tendon, which is often involved in orthopedic injuries.

This project is supported by the Fresnel and ISM Institutes. **Tilman Grünewald, with Martine Pithioux and Sandrine Roffino**, will establish the relation between the hierarchical organization and the mechanical properties of the enthesis and use this information to develop a micromechanical model of the enthesis.

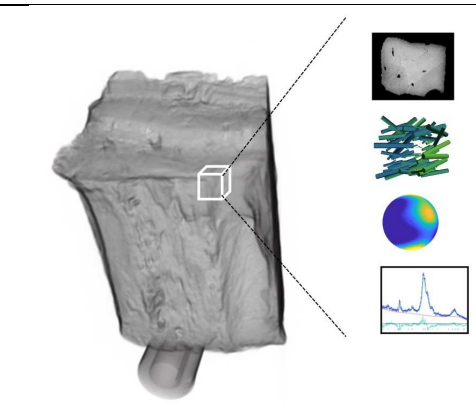

Fig 1 : Schematic representation of Texture tomography and the extracted quantities on tissue density, nanoscale orientation, crystallographic texture and crystalline properties

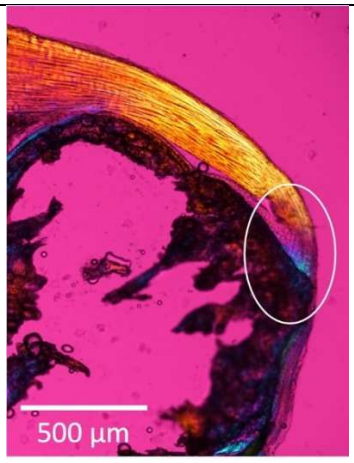

Fig 2 : Polarized light microscope image of the enthesis

Keywords :
Enthesis, X-ray diffraction imaging, crystallographic texture, biomineralization, biomechanics

Project partners :
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Aarhus University, Aarhus, Denmark
Paul Scherrer Institute, Villigen, Switzerland
Vienna University of Technology, Vienna, Austria