ESRF	**Experiment title: High resolution SAXS and WAXS investigations of bone nanoparticles at the mineralization front**	**Experiment number**: SC-4104
Beamline: ID 13	**Date of experiment**: from: 29 Nov 2015 to 02 Dec 2015	**Date of report**: Feb. 2020
Shifts: 9 shifts	**Local contact(s)**: Dr. Manfred Burghammer	*Received at ESRF:*

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Report:

The work based on this experiment has succesfully been published:
Roschger, A., Wagermaier, W., Gamsjaeger, S., Hassler, N., Schmidt, I., Blouin, S., ... & Paschalis, E. P. et al.
Newly formed and remodeled human bone exhibits differences in the mineralization process. **Acta Biomaterialia** *(2020).*

Abstract:

During human skeletal growth, bone is formed via different processes. Two of them are: new bone formation by depositing bone at the periosteal (outer) surface and bone remodeling corresponding to a local renewal of tissue. Since in remodeling formation is preceded by resorption, we hypothesize that modeling and remodeling could require radically different transport paths for ionic precursors of mineralization. While remodeling may recycle locally resorbed mineral, modeling implies the transport over large distances to the site of bone apposition. Therefore, we searched for potential differences of size, arrangement and chemical composition of mineral particles just below surfaces of modeling and remodeling sites in femur midshaft cross-sections from healthy children. These bone sites were mapped using scanning synchrotron X-ray scattering, Raman microspectroscopy, energy dispersive X-ray analysis and quantitative backscattered electron microscopy.

The results show clear differences in mineral particle size and composition between the sites, which cannot be explained by a change in the rate of mineral apposition or accumulation. At periosteal modeling sites, mineral crystals are distinctly larger, display higher crystallinity and exhibit a lower calcium to phosphorus ratio and elevated Na and Mg content. The latter may originate from Mg used for phase stabilization of mineral precursors and therefore indicate different time periods for mineral transport. We conclude that the mineralization process is distinctively different between modeling and remodeling sites due to varying requirements for the transport distance and, therefore, the stability of non-crystalline ionic precursors, resulting in distinct compositions of the deposited mineral phase.