The role of iron in the fossilization of soft parts of vertebrates – popular science abstract.

The presence of preserved soft parts (such as blood vessels or bone cells) in fossilized bones from millions of years ago is a phenomenon that has been known for decades. So far, however, there is no consensus in the scientific community whether the preserved structures represent the original soft tissues preserved in the bones of prehistoric animals, or whether they are the remains of secondary processes of bone processing by microorganisms. The first interpretation is supported by the results of new, highly specialized proteomics studies and immunohistochemistry. However, it remains a mystery how these structures preserve in a fossil state. The second puzzle is the high concentration of iron in these samples, mainly in the form of iron hydroxide (goethite), which is strongly associated with occurrence of the preserved soft parts. Undoubtedly, iron minerals play a role in the fixation of these microstructures. The assumption of the project is an attempt to answer the question of where the iron which supplies the crystallization of oxides that currently build fossilized soft tissues comes from, and in particular, whether the source of this iron could be porphyrins and proteins – iron-rich biomolecules, which during the life of the animal built its body tissues. The adopted working hypothesis assumes the migration of iron from biological systems (original body fluids, e.g. blood) to the mineral state, which is thermodynamically stable iron oxides. This migration path of iron will leave an imprint on its properties as well as on the properties of the minerals that it currently contains. These properties can be read by analyzing samples using a variety of instrumental methods, including Mössbauer spectroscopy and X-ray microspectroscopy. The research will include fossilized bones of vertebrates (including dinosaurs) and ossified dinosaur tendons, obtained both as a result of museum queries and directly as a result of fieldwork. The project's results will help to understand the role of iron as a factor in promoting the fossilization of soft parts and, at the same time, as a carrier of paleobiological information. Moreover, the results of the project will help to assess to what extent various ferruginous minerals formed in different thermodynamic conditions can constitute a kind of "time capsule", in which original biomolecules of prehistoric animals can survive in a stable state to this day.