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# XANES and micro-XRF spectroscopies for chemical characterization of fossil samples

Presenter: Maldanis L.

Maldanis L.*; Perez C. A.; Lima F. A.; Rodrigues F.; Galante D.; Xavier-Neto J.

*Brazilian Synchrotron Light Laboratory; Brazilian Biosciences National Laboratory; Chemistry Institute, University of São Paulo.*
lara.maldanis@lnls.br

The application of novel analytical techniques to study fossils is enabling new and more sophisticated scientific problems to be attacked in paleobiology, both in morphology and chemical composition of the specimens and of the surrounding rock matrix, with none or minimum damage to the sample. Particularly, micro-X-Ray Fluorescence spectroscopy can be applied onto chemical mapping of paleontological specimens, allowing the correlation of chemical findings with morphological features, which can provide a range of information about biochemical preservation of the specimen structures and also about the fossilization process. We applied micro-X-Ray Fluorescence in fossil fishes from the Cretaceous Santana Formation of North-East Brazil and in fixed and resin-included Zebrafish samples, to analyze and correlate the distribution of the elements, that could be associated with biological or diagenetic origin. We also applied XANES spectroscopy to better characterize the iron minerals of the fossil and its matrix, besides look for possible remains of hemoglobin preservation. Our results show the association of elements as iron and zinc with specific structures as bones, gastrointestinal tract and scales, both in the fossil and Zebrafish samples. Other elements, as manganese, appears as a diagenetic marker, distributed nonspecifically in the fossil. We can also observe rare-earth elements as neodymium associated to geochemically modified apatite. XANES spectroscopy of iron showed a clear contribution of pyrite in the matrix and some regions of the fossil sample, but could not identify hemoglobin traces in the fossil sample, probably because of the very low (if present) concentration of this kind of iron among the iron minerals of the sample.