ABSTRACT

Micro-Raman spectroscopy in diagnosing skeletal pathology in chick embryo tibiotarsi exposed to platinum group metals. Platinum group metals (PGMs) have been shown to accumulate in various tissues of organisms but their toxicity is not well-known. Raman spectroscopy is a powerful analytical technique that enables direct and non-destructive chemical characterization of bone tissues. PGMs were injected into chick embryos in the following concentrations: 0.1, 1.0, 5.0, or 10.0 ppm solutions of Pt (IV), Rh (III), Pd (II) or PGMs mixtures (0.1 ppm or 1.0 ppm of each metal). The micro-Raman maps recorded on the paraffin embedded tibiotarsus cross-sections showed significant changes in the chemical composition and structure of the bone tissue as a result of PGMs exposure of 1 ppm (i.e., anomalous calcium inclusions impeding circulation in cartilage matrix). The following bone properties were analyzed and quantified via micro-Raman spectroscopy: a) age of mineral crystals and carbonate content, b) degree of mineralization of the collagen matrix and possible losses in the organic/inorganic bone components and c) mineral crystallinity. X-Ray fluorescence showed significant changes in the distribution and quantity of calcium and phosphorus due to the PGM treatments. Flame atomic absorption spectroscopy also
revealed changes in the amount of calcium found in the tibiotarsi. All three analytical techniques correlated well with each other showing the calcium inclusions negatively affecting the bone structure of the chick embryo tibiotarsi.