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Application News

No.P96

Electron Probe Microanalyzer

Bone Tissue Analysis

Introduction

The tissue of a living organism is mainly comprised of soft tissue and hard tissue. Among the hard tissues, bone tissue is mainly composed of calcium carbonate. There is a strong relationship between the metal elements present in the hard tissue of an organism and the development (growth) of that organism. Obtaining the concentration and distribution of these metal elements in hard tissue helps us to understand the living environment and health condition of an organism.
This article describes an analysis of the metal elements present in fish otoliths and animal bone tissue.

Otoliths

Fish otoliths (sagitta) contain visible concentric rings (daily rings and annual rings) that can be used to examine the age and growth rate of the fish. Otoliths are mainly composed of calcium carbonate ($CaCO_3$), though they also contain a very small quantity of strontium (Sr). Some of this strontium is believed to originate from the fresh water or saltwater habitat of the fish. When Sr is taken up by fish, it accumulates in the otolith in place of Ca during growth. Determining the concentration of this Sr in the otolith allows us a brief glimpse of the past habitats of that fish.
The very small quantity of Sr present in an otolith changes in concentration moving the center of the otolith to its edges. Using the pattern of variation in Sr/Ca concentration ratio, we can learn about a fish's movements between fresh water and saltwater. Such data is also helpful to work that concerns itself with the protection of natural resources.

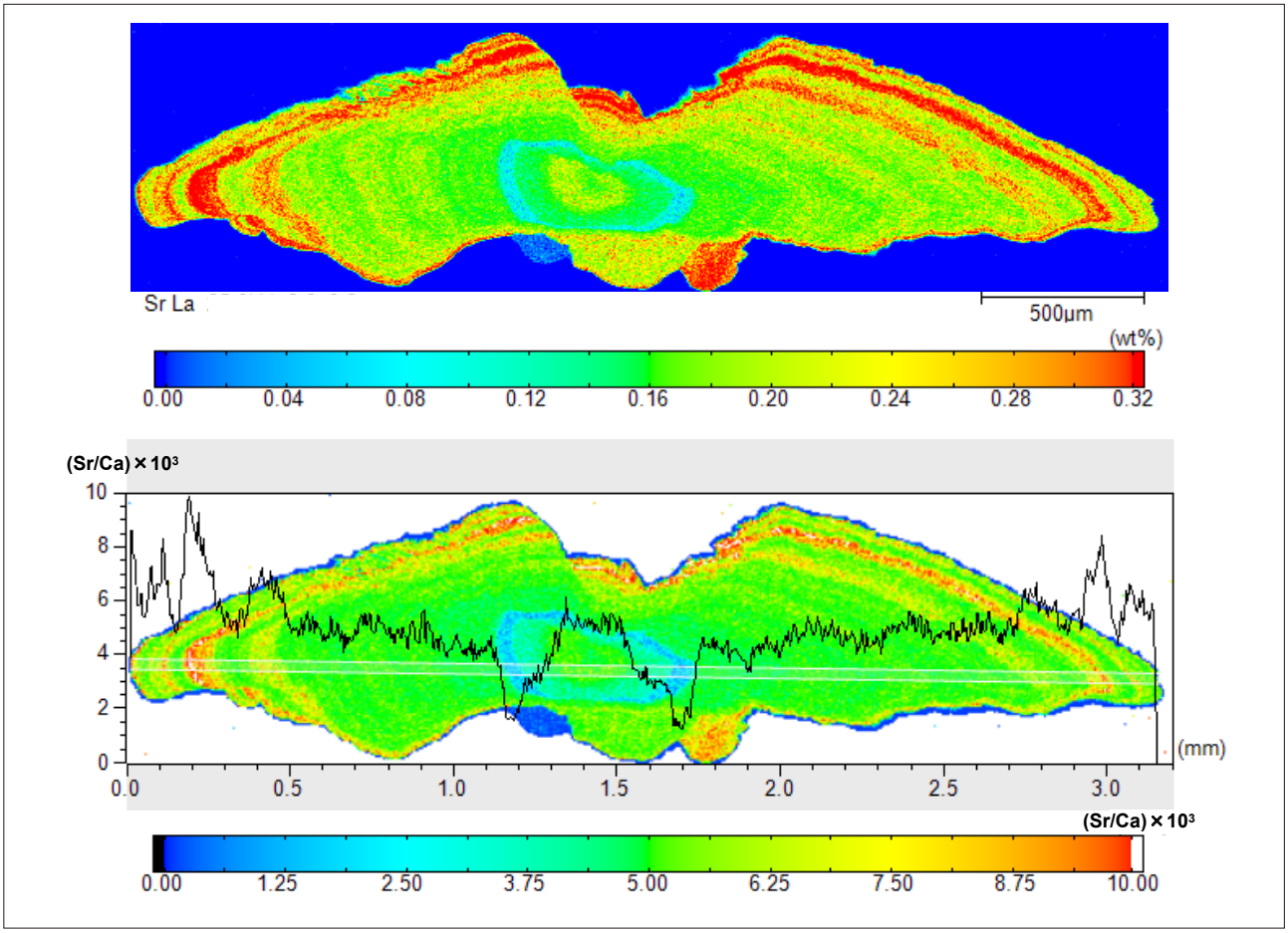

Fig. 1 A Chum Salmon Otolith

Sample provided by Hideaki Kudo, Associate Professor, Graduate School of Fisheries Sciences, Hokkaido University

Diffusion of Metal into Bone Tissue

In the field of regenerative medicine, the biocompatibility of materials is evaluated for research and development of materials for medical use. For example, while titanium alloys for medical use are very strong and have excellent corrosion and thermal resistance properties, concerns remain with respect to the compatibility of these materials with bone tissue relative to conventional materials for medical use. Recently, low rigidity titanium alloys that possess good compatibility have been developed and are expected to be used for medical purposes.

Under such situation, when the diffusion of manganese (Mn) into bone tissue was examined using an electron probe microanalyzer (EPMA) after implantation of a Ti-12Mn low rigidity titanium alloy (binary alloy) and a commercially pure titanium alloy in rabbit bone tissue, very small quantities of Mn were found in the bone tissue surrounding the metal implant. While bone tissue already contains a very small quantity of Mn, the effect of this leakage on subject health is being investigated.

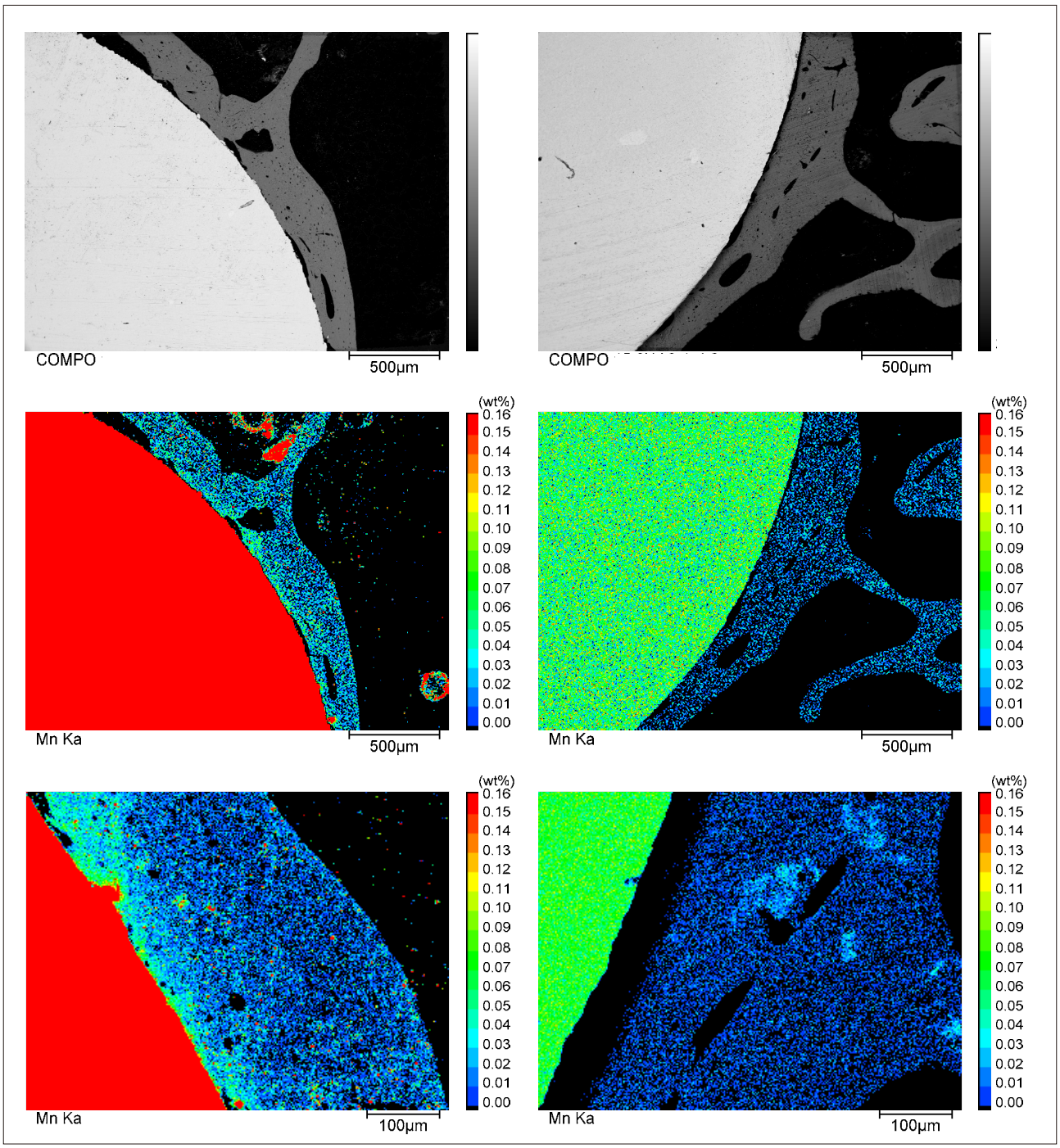

Fig. 2 Ti-12Mn / Bone Tissue, Commercially Pure Titanium / Bone Tissue

Samples provided by Tomokazu Hattori, Professor, Faculty of Science and Technology, Meijo University

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