Abstract

Near infrared spectroscopy of fossil antelope bone from South Africa

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Introduction

Raw materials for constructing bone are supplied by food, water and air, and are ultimately sourced from the external environment. Bone chemistry consequently records the living environment of an animal, and such information may persist after death and into the fossil record. Chemical alteration of bone during burial (diagenesis) may erase the life history signals from fossil bone, however, severely reducing the analytical utility of fossil material. We have used NIR spectroscopy to screen fossil bone for signs of diagenetic alteration.

Materials and Methods

Fossil antelope bone from the Western Cape of South Africa was studied using two instruments: 1) large sample volume (bulk) measurements were collected using a Spectrum IdentiCheck FT-NIR, and 2) low sample volume (hyperspectral, chemical imaging) measurements were collected using a sisuChema short wave infrared imaging system.

Results and Discussion

Bulk NIR spectroscopy indicated that secondary minerals had been deposited within the fossil bone. Fossils from different sites could be distinguished by secondary mineralogy, with bone from coastal Swartklip 1 featuring calcium carbonate (calcite) and inland Elandsfontein Main exhibiting clay mineral infill. Hyperspectral NIR spectroscopy allowed the distribution of secondary minerals to be mapped. Both clay and calcite were concentrated in cancellous spaces, as residues of deeply infiltrating pore water. Water is the primary agent of diagenetic alteration and NIR data indicated that the fossil antelope bones had been saturated.

Conclusions

NIR spectroscopy provided evidence for ancient pore water movement through fossil antelope bone. Different secondary minerals had accumulated inside bones from different sites and informed of different palaeo-environments. We found NIR spectroscopy to be a useful tool when screening fossil bone for evidence of diagenetic alteration.

Reference paper as:
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