

Preliminary Analysis of C and H in a “Sangiran” fossil Using Laser-Induced Plasma at Reduced Pressure

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Abstract

A Nd:YAG laser (1064 nm, 120 mJ, and 8 ns) was focused on various types of fossil samples, including fossilized buffalo horns (around 400,000 and 1×10^6 years old, respectively) found in Sangiran, Indonesia. Such fossils represent an important starting point for tracing man's origin and evolution during the Pleistocene era. Carbon emission was found in a horn fossil dated at 1×10^6 years. Some molecular band spectra were also found in all the fossils examined in this study. It was assumed that by combining information on carbon emission, hydrogen emission, and molecular band spectra that the degree of fossilization might be quantitatively calculated. Further results showed that silicon emission is not detected in old fossils, but it is present as a major constituent. This is probably due to the fact that silicon is strongly bound to other elements in old fossils and is ablated in the form of clusters. In order to prove the above hypothesis, a thin film of an old fossil was deposited on a silver plate substrate by means of a laser ablation technique. The resulting film was then irradiated and atomic emission lines of silicon were clearly detected. A comparative study of the low-pressure plasma introduced in this study was conducted using the well-known laser-induced breakdown spectroscopy technique and the results confirmed that operating conditions at atmospheric pressure are unfavorable for as fossil analysis.