Application of stable isotope analysis methods for reconstructing paleoenvironment and paleoclimate in sediment cores

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ABSTRACT

Reconstruction of paleoenvironment and paleoclimate aims to clarify the interaction of environment and climate in the past, providing useful information for understanding the change in natural and social climate in the future. However, this research area has not been commonly carried out in Vietnam. This present study aims to contribute the methodologies and research methods for solving this gap by presenting the sampling and analytical methods of stable isotopes (\(\delta^{18}O\), \(\delta^{13}C\)) in sediment cores. An experiment was performed for a certified reference material – Alleya to demonstrate the analytical errors of \(\delta^{18}O\) and \(\delta^{13}C\) by the Na-HMS system. Additionally, the correlation of \(\delta^{18}O\) and \(\delta^{13}C\) from the samples from a sediment core from the Phu Hai Lagoon in the Buon National Park, the Kun province has been presented in detail. Temporal variations of \(\delta^{18}O\) and \(\delta^{13}C\) values demonstrated that the climate regime of the area was affected indirectly with Asian monsoon, and the water flows from surrounding areas to lake resulted in increase from the 1960s to now to the present.

Keywords: Stable isotopes, paleoenvironment, paleoclimate, climate, sediment, Buon Lagoon.

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1. Introduction

Paleoenvironmental and paleoclimatic reconstructions tools (methods and clarify the characteristics of climate and the environment in the past) (Kilian and Lamy, 2012; Long and Marshall, 2004). These studies provide crucial information for simulating the change of climate and environments in the future (Stocker et al., 2014). The sediment cores can achieve various climate and environmental indicators such as temperature, humidity, and precipitation in the past (Long and Marshall, 2004). Analysis of such indicators achieved in sediments (stable isotopes, micro-fossils, pollen, organic matter compositions and sedimentary compositions) has been widely applied in many regions of the world (Wanner et al., 2000; Villalba et al., 2009; Börger et al., 2012; Kilian and Lamy, 2012.).

Paleoenvironment and paleoclimate in Vietnam have been reconstructed using sediment characteristics, pollen and diatoms in the sediment cores (e.g. Li et al., 2004; Tranbui et al., 2006; Nguyen and Doong, 2011). The analysis of \(\delta^{18}O\) dating and sedimentary features in the Red River Delta showed that the transgression phase was taken