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U/TH dating of travertines from Hungary: paleoclimatic and tectonic interpretations

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During the Pliocene and Quaternary the area of the Buda and Gerecse Mts. (Hungary) were characterised by strong hydrological activity. As a result, many local travertine deposits were formed on different terrace levels of the Danube River. In the frame of our research we achieved sedimentological and geochemical studies on these travertines. Almost 100 occurrences were sampled and their position and elevation were determined using GPS. Besides the detailed petrographic analyses stable carbon and oxygen isotope measurements of more than 625 samples were performed using Finnigan delta Plus XP mass spectrometer. U/Th dating were completed in the laboratory of the National Taiwan University on 58 samples collected from 53 Hungarian travertine sites using Thermo Electron Neptune mass spectrometer and Multi Collector – Inductively Coupled Plasma Mass Spectrometry techniques.

Our results demonstrated that the sedimentological and stable isotope geochemical analyses of the Hungarian travertines, together with U/Th dating methods are suitable to provide important paleoenvironmental, paleoclimatic and tectonic information. With the help of the new U/Th data of travertines of the Buda and Gerecse Mountains it was possible to reconstruct the relocation and development of paleokarst springs, to clarify the relation between travertines and former Danube-terraces, to calculate the uplift rate of the Gerecse and Buda Mts. (incision rate of River Danube), and to determine the deposition rate of travertines. The petrographical analyses of the travertines collected from the investigated occurrences helped to reconstruct their depositional environments. Based on the new U/Th age data the periods of travertine formation were determined, in relation to glacial-interglacial periods. The U/Th data showed that the travertine deposition was significant in both mountains during the Middle-Pleistocene.

Using the stable isotope and trace element data of freshwater limestones of the Gerecse and Buda Mountains, and their U/Th age and elevation above the see level, it was possible to classify them genetically, and to provide new information on the nature of their paleohydrothermal activity. Looking at the stable carbon isotopic compositions a clear territorial difference can be observed between the Gerecse and Buda Mts., and local differences are also exists within both mountains. The stable oxygen isotope data show correlation with the age of travertines. Correlation with the SPECMAP and Vostok ice-core (Petit et al. 1999) curves indicates that the oxygen isotope compositions of the travertines of Gerecse Mts. were influenced by the global change of climate.

The results of this work may serve as a base of the detailed study of the individual travertine occurrences, providing new data on the paleoclimatology of the Carpathian Basin and on the local paleoenvironment and tectonic conditions.