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Depositional facies and stable isotope geochemistry of some Hungarian travertine occurrences

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Stable isotope analyses on travertines has been started in the last few years in Hungary. Petrographic and geochemical studies were carried out on four different travertine deposits. These occurences have different origins and consequently they revealed diverse isotopic composition (Fig. 1). In addition, the sedimentological processes that influenced the depositional environment and the developed alternating facies can also be followed by the $\delta^{13}C$ and $\delta^{18}O$ variations. We have compared the stable isotope compositions of travertines of different ages (from Cretaceous to recent) and localities (from the Transdanubian Mts., Central Hungary, to the Bükk Mts., NE-Hungary).

The major goal of this study is the analyses of the recent travertine accumulation near Egerszalók (Bükk Mts.). The „Hungarian Pamukkale" located in a small area but represent almost all travertine microfacies type and offers a good opportunity to study stable carbon and oxygen isotope fractionations between water and calcite at surficial conditions.

The water discharges on the slope of a hill and flows down along the slope until it reaches a small basin. We sampled the thermal water and associated travertine accumulations at two different flowpaths and from different microfacies types. The Egerszalók travertine has mean isotope compositions at $\delta^{13}C=3.1‰$ and $\delta^{18}O=12.1‰$. We observed a rapid degassing of CO_2 revealed by the abrupt increase of the carbon isotope values from the vent to the rims (Fig. 2), that is also indicated by the changes of pH values of the water. The measured oxygen isotope values suggest that the cooling of the water has obvious effect. However, our results differ from the theoretical calcite-water isotope equilibrium at the given temperatures (Fig. 3).

The Tata travertine complex ($\delta^{13}C_{mean}$= -5.3 ‰) show marked $\delta^{13}C$ difference from the travertine occurrences of the Buda Mts. (Buda-Vár-hegy: $\delta^{13}C_{mean}$= 1.5 ‰; Budakalász: $\delta^{13}C_{mean}$= 2.0 ‰), while the stable oxygen isotope compositions are the very similar.

The Pleistocene travertine complexes (Tata, Kőpite Hill, Budakalász, Buda-Várhegy) show small $\delta^{18}O$ scatter, but their $\delta^{13}C$ ranges show marked differences. The $\delta^{13}C$ variations may be related to local effect of organic matter oxidation (see Kele et al., this volume). The Buda-Várhegy occurrence has $\delta^{18}O$ values similar to the Egerszalók deposit known to be formed at elevated temperature (up to 60 ºC), thus the locality-related $\delta^{18}O$ changes may be related to formation temperature differences. The Tata complex was studied in detail that indicated significant differences in the vent and cascade facies. The stable isotope compositions – as well as its origin - of the presumed upper Cretacous travertine cone of the Vértes Mts. differ completely from those of the younger travertine occurrences (Siklósy et al., this volume). However, the within-complex variations are rather similar in the travertines with marked differences between different depositional facies. The $\delta^{13}C$-$\delta^{18}O$ correlations and shifts can be modelled by cooling, degassing and disequilibrium calcite precipitation using the analogue of the recent carbonate formation.

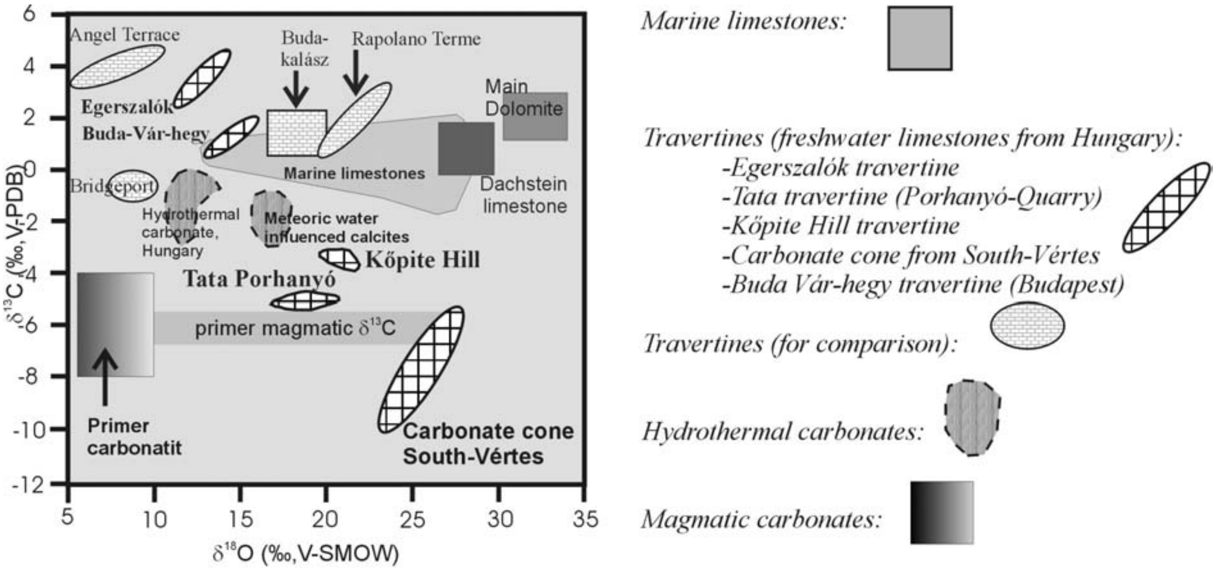

Fig. 1. Stable carbon and oxygen isotope values of different originated carbonates.

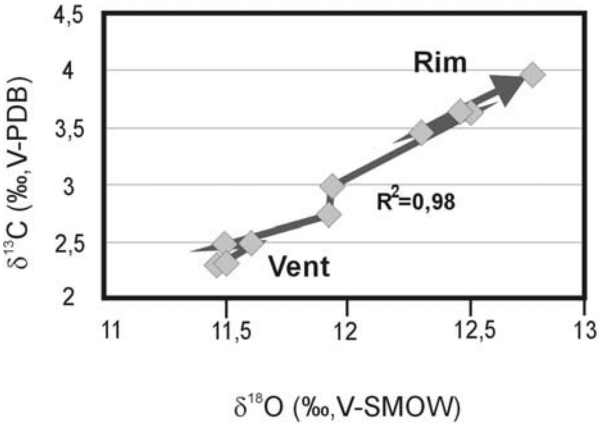

Fig. 2. Isotopic composition of the Egerszalók travertine. Samples were collected along the flow direction.

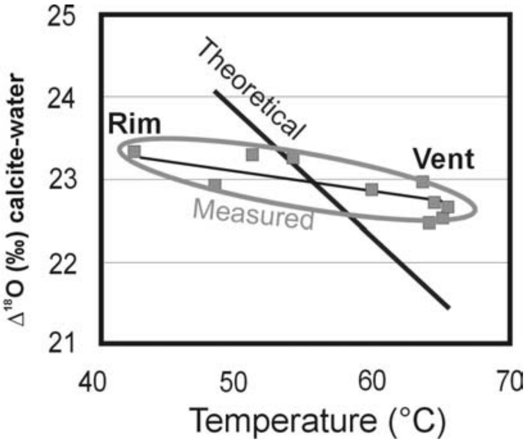

Fig. 3. The theoretical and measured oxygen isotope fractionation between the calcite and water

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