A new approach for dating young carbonate samples using ingrowth ^{226}Ra

M.-L. FROESCHMANN[1*], D. SCHOLZ[1], H. VONHOF[2], K. P. JOCHUM[2], C. PASSCHIER[1], G. SÜRMELIHINDI[1]

[1]Institute for Geosciences, Johannes Gutenberg University, Mainz, Germany ([*]correspondence: mfroesch@students.uni-mainz.de)

[2]Max Planck Institute for Chemistry, Mainz, Germany

Holocene carbonate deposits provide important information about past climate variability and therefore precise absolute dating is essential for paleoclimate reconstruction. Using traditional methods like ^{230}Th/U-dating to date Holocene carbonates with high detrital contamination can result in large uncertainties for the obtained ages [1]. Another option is excess ^{226}Ra dating of samples where the initial ^{226}Ra activity is known. However, for a lot of terrestrial samples, the initial Ra activity is unknown and excess Ra can only be used to obtain the age difference between the oldest and youngest material deposited.

Here we present a new model approach for dating young carbonate samples using ingrowth ^{226}Ra. The method relies on the geochemically similar behavior of Ra and Ba, which results in comparable partition coefficients for these two elements [2]. We use this relationship to correct for excess ^{226}Ra. Combined with a simultaneous correction for detrital ^{226}Ra, the amount of ingrowth ^{226}Ra can be calculated. In a three-dimensional ^{226}Ra-^{232}Th-Ba isochron-diagram, the intercept with the z-axis gives the amount of ingrowth ^{226}Ra. However, when working with natural samples, the measured activities are all subject to errors. In order to account for those uncertainties in all three dimensions, we apply Moniot´s method of a least squares fit [3] to the model data. The final equation for calculating the age using ingrowth ^{226}Ra is based on Bateman´s solution for a system of differential equations [4].

This new approach is especially interesting for samples where traditional dating methods are not precise enough and it offers new possibilities for high-resolution palaeoclimate reconstruction on Holocene time scales.

[1] Wenz *et al.,* (2016) *Quat. Geochronol.,* **32**, 40-52. [2] Rihs, Condomines and Sigmarsson (2000) *Geochim. Cosmochim. Acta,* **64**: 661-671. [3] Moniot (2009) *Appl. Numer. Math.*, **59**: 135-150. [4] Bateman (1910) Proc. Cambridge Philos. Soc., **15**, 423-427.