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Optical dating of arid coastline deposits – the challenge of dating evaporitic sediments

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The Arabian Gulf is a small shallow marginal sea of the Indian Ocean. Its Pleistocene-Holocene sea-level history is of great interest for reconstructing human migration routes into Mesopotamia as well as for better understanding the recent convergence rate between the Arabian and Eurasian plates. For establishing the sea-level history, the ages of past shoreline deposits must be known.

Here we present the optical dating procedure of intertidal carbonate deposits sampled in the coastal area south of Abu Dhabi city (United Arab Emirates). We focus on the challenge of determining a reliable dose rate of samples that are in secular disequilibrium and compare our results with age data obtained from AMS ¹⁴C dating.

For optical dating quartz grains of 90-150 μm were extracted and the equivalent dose was determined from 1 mm aliquots using a standard single-aliquot regenerative dose protocol. Data analysis employed statistical analysis to approximate the palaeodose assuming that all grains measured were sufficiently bleached at time of deposition. For determining the dose rate the radionuclide activities were first quantified by simulating the radiation field of the chemically and physically described samples using gamma spectrometry. These modern activities were then taken to back calculate the activities using well-described double differential equations for open systems. This approach leads to multiple solutions.

We show details of the approach and discuss on the basis of the solutions reasonable open-system assumptions for various sedimentary environments.