The sea-level signal in Pleistocene shallow-marine records – examples from carbonate and siliciclastic sequences

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It is generally accepted that sea-level change represents the most important boundary condition that controls stratigraphic architecture in the shallow-marine area and further downdip. The shallow-marine stratigraphic body is then a result of the changing ratio between sediment supply and accommodation space with a range of local (autogenic) processes interplaying with the eustatic (allogenic) sea level. Extracting the sea-level signal from this interplay is typically approached through rigorous interpretation of the indicative meaning of relevant sea-level markers and through comparison with the most appropriate glacio-isostatic adjustment (GIA) model. The latter comparison is insightful for the last glacial period, but for the Pleistocene it suffers from the dilemma that the GIA contribution to sea-level change cannot be predicted for a specific location unless the ice history is known but this is what the shallow-marine record is trying to reconstruct.

Here we aim for Pleistocene sea-level reconstructions that are largely independent of GIA predictions. For this we present Pleistocene shallow-marine records from high-, mid- and low-latitudinal settings. The presentation focuses on four aspects: type and quality of the data (e.g. outcrop, borehole, etc), preservation of the record, separation of allogenic versus autogenic signal and completeness of the eustatic cycle.

We show that in siliciclastic systems the preservation depends on sediment supply and on the coastal energy with which ravinement and regression surfaces obliterate the stratigraphic record. Separating autogenic from allogenic signals depends very much on data quality and the ability to reconstruct the antecedent topography. None of our records show a complete eustatic cycle from lowstand to highstand and back to lowstand where the missing part of the cycle seems to be indicative for the type of shallow-marine record and its location on earth.

We discuss reasons and implications of our findings and emphasise the need for far greater consideration of stratigraphic architecture, carbonate facies and facies correlation.