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Unravelling the stratigraphic signature of composite 100/20-ka cyclicity: the importance of sediment pathways and supply fluctuations during Quaternary glacial-interglacial cycles (Adriatic Margin)

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Cyclical depositional sequences characterized by overall progradational architecture are known from many Quaternary continental margins where the dominant sea level signal is paced by the 100-ka orbital cycle. Similar progradational sequences have also been described on land and referred to phases of sea level fall during 40 or 100-ka cycles of the Pliocene and Lower Pleistocene. However, the precise chronology of these depositional sequences, and their correlation with sea level curves derived from deep-sea oxygen isotope records, remain uncertain.

We present a case from the Adriatic margin where shelf sequences are physically correlated with a deeper-water succession for which oxygen isotope record is available. This record is obtained from PRAD1-2, a 71 m-long borehole drilled at ca. 186 m water depth within the frame of the European Project PROMESS-1 (PROfiles across the MEditerranean Sedimentary Systems). PRAD1-2 stratigraphy provides an isotopic record for the past ca. 400 ka (Marine Isotope Stages and Sub-stages from 1 to 11) and is correlated with shallow water progradational units composing the internal architecture of unconformity-bounded sequences on the shelf. Independent sequence-stratigraphic reconstructions and numerical modelling suggest that these sequences and their internal progradational units reflect a cyclic interplay between sea level and oceanographic circulation, with relevant feedbacks on sediment supply fluctuations and regional long-shore sediment dispersal. By comparing the sea level curves derived from the oxygen isotope record with the sea level and supply changes inferred from the stratigraphic architecture of shallow-water deposits we decipher the stratigraphic signature of composite 100 and 20-ka Milankovitch cyclicity on the continental shelf. Based on this result, we conclude that:

a) the supply fluctuation mechanism predicted by sequence-stratigraphic reconstruction and numerical modelling controls the clinoform geometry of 20 ka progradational units composing individual 100-ka sequences;

b) the changes in clinoform geometry of progradational units are consistent with a mechanism of switching supply from dominant advection on a flooded shelf, during highstands, to overall sediment starvation on a narrowed shelf, during lowstands.

These findings emphasizes the importance of sediment bypass and redistribution in shaping sequences and margin architecture during short-term sea level changes, and also have relevant implications for sequence-stratigraphic interpretation and modelling of Quaternary continental margins.