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Sedimentological analysis of large-scale cross-beds from the Burdigalian mixed carbonate-siliciclastic succession of the Bonifacio Basin (South Corsica)

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This study investigates the sedimentological aspects of metre-scale cross-bedded units recorded into a succession of mixed carbonate-siliciclastic sediments. The studied succession, up to 130 m thick, crops out in the surroundings of Bonifacio (South Corsica, Mediterranean Sea) and was deposited during the rotation of Sardinia-Corse microplate, which occurred between ∼21 and 15-18 Ma and determined a 45° counter-clockwise rotation of the Sardinia-Corse block. The mixed carbonate-siliciclastic succession, Burdigalian in age, lies in non-conformity over Hercynian granites or Tertiary volcanics and can be divided into 12 lithozones.
The middle and upper parts of the succession are characterized by cross-bedded units. The research focuses on the upper part of the succession, where thick and continuous bedsets are well exposed.
Measurement and sampling of stratigraphic sections, detailed sedimentological analysis and thin sections analysis have been performed on these sediments.
In order to constrain the processes responsible for cross-beds deposition, paleocurrent orientations were estimated according to the orientation of trough cross bedding and dune-lee side surfaces: foreset, toeset and bottomset surfaces.
The analyzed cross-bedded unit outcrops in the Ancienne Batteries zone, nearby Bonifacio and along the road to Portovecchio.
The cross-bedded unit is characterized by hybrid calcarenites composed of red algae, bryozoans, bivalve and echinoid fragments. The siliciclastic components (fragments of the underlying granites) are generally accessorial.
Each bedset ranges in thickness from 1 to 2 meters on average.
The lower bounding surfaces of these bedsets are primary planar but erosive, at different degrees, with respect to the underlying bedsets.
The foresets have a sigmoidal to exponential profile (according to their preservation potential) and locally show scars and small folds (interpreted as evidence for collapse structures), whereas the bottomsets have a tangential profile. The bed surfaces are characterized by intense echinoid bioturbations. Millimetric parallel laminations are present within the foresets and bottomsets.
The internal organization of the cross-bedded unit is characterized by conformable or reactivation surfaces.
The paleocurrent analysis shows that the currents were mainly directed to the S-SW, almost parallel to the orientation of the borders of the basin.
Sedimentological observations and paleo-current distributions indicate that the cross-bedded units can be interpreted as hydraulic dunes developed in a paleostrait where marine currents were accelerated, favouring the development of these structures, probably more efficient during high energy events (such as storms). Changes in the energy of the currents controlled the deposition of each cross-bedded strata.