Facies, architecture and genetic controls of carbonate ramp aprons development

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Cool-water Carbonate Ramp Aprons (CRA) are depositional systems in which skeletal sand and gravel are redistributed basinwards on a ramp, off a shallow carbonate platform by tractive currents as a result of flow funnelling in between topographic highs. These deposits are different and should not be confused with the carbonate apron models proposed by of Mullins and Cook (1986) who describe either carbonate deep water turbiditic systems accumulated at the base of the slope or talus cones formed at the margins of carbonate build ups.

A key example of CRA facies assemblages is represented by the Early Pleistocene, Favignana Calcarenite where bimodal depositional processes, occurring in a water depth range estimated between 5 and 80 m, typical of this depositional environment, resulted in the accumulation of distinct and alternating sedimentary packages: a low- energy sedimentary assemblage formed by typical subaqueous dunes consisting of tabular cross bedded grainstones and packstones often bioturbated is coupled with a heterogeneous facies assemblage where, coarse-grain filled erosional depressions, largely variable in size, formed by downslope confined flows generating elongated scours are associated with low- angle cross bedded grainstones formed in supercritical conditions (backset bedded, antidunes etc).

Based on outcrop examination and 2D seismic line interpretation CRA deposits have a triangular shape which form a series of coalescent fans forming an overall apron connecting the shallow carbonate platform/ inner ramp setting (factory) to the deeper basin through a steep ramp. The seismic data in particular allow the deciphering of the internal architecture and understanding the modality of progradation and aggradation and lateral shift of these sedimentary bodies. In the sedimentary record the carbonate ramp aprons develops a wedge-like geometry composed by discrete superposed and laterally stacked lenticular bodies often separated by erosional surfaces marked by reflector discontinuities. The frequency of erosional/reactivation surfaces attest for frequent high-energy events which, in the basis of sedimentary facies present in outcrops, demonstrate the important role plaid by high-energy storms and possibly tsunamis in building these deposits.

Similarly to what has been described for the Favignana Calcarenites, CRA deposits can represent an important part of ancient sedimentary record of intrashelf carbonate successions such as the Oligocene/Miocene carbonate successions in the Gulf of Venezuela. There, well-sorted calcarenite drift deposits forming similar well-sorted calcarenite drift apron-shaped deposits, similar to the ones described in Favignana are visible in the topographic lows, next to steep platform margins.