Geophysical Research Abstracts
Vol. 13, EGU2011-11604, 2011
EGU General Assembly 2011

Geometry and facies distribution of a biocalcarenitic wedge; Favignana Island, Sicily, Italy

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The eastern side of Favignana (19 km2), the major island of the Egadi archipelago located offshore western Sicily (Italy), consists of Plio-Pleistocene calcarenites. These are characterised by a wide range of prograding sediment bodies comprising mainly coarse to very coarse, very porous grainstones. Biological assemblages are made of fragmented rhodoliths (red algae), bryozoa, echinoids and (mainly benthic) foraminifera with, in places, well preserved mollusc shells, and are largely devoid of hermatypic (reef-building) corals, calcified green algae and non-skeletal grains, indicating a relatively cool-water origin. This is confirmed by the presence of so-called Boreal Guests (e.g. Arctica islandica) at the base of the wedge.

Most exposures are unaffected by deformation, but locally outcrops are intersected by extensional faults with displacements in the order of metres. Additionally, post-depositional tectonic tilting of a few degrees has occurred. Quarrying which took place since ancient times and on an industrial scale in the second half of the 20th century, resulted in the excellent Cave di Tufo exposures distributed all over the study area. The latter, along with the island's barren north, east and southeast sea-facing cliffs, allow for a detailed three-dimensional reconstruction of lateral and proximal/distal facies distributions.

Overall, two facies assemblages are recognised in the field which indicate a dominantly high-energy depositional environment: (1) small-scale trough cross bedding, large sets of stacked tabular cross beds, large-scale dipping strata forming 50 to 100 m prograding clinoforms, horizontally bedded homogeneous bodies (intensely bioturbated with complete mollusc shells), and large-scale lenticular beds consisting of laterally stacked sigmoidal cross-stratified beds. (2) Large-scale (up to 50 m wide and 30 m deep) scours with an overall homogeneous, poorly sorted infill with concentrations of large clasts at the base (extraclasts, rhodoliths, disarticulated unbroken shells), chute-and-pool structures, antidunes, and horizontal to undulated plano-parallel laminated beds, with lateral thickness changes and parting lineation on bed surfaces.

These high-energy structures, in places reflecting supercritical currents, and the absence of encrusting structures and colonisation of the sediment surfaces indicate high-energy transport and deposition in the likely proximity of a carbonate platform. Transport to the SE suggests that a carbonate factory was located between Favignana and Levanzo, another Egadian island situated ca. 5 km to the north. In particular, assuming a similar tectonic origin for the Mesozoic ridges of these two islands, a shallow area in between may have hosted cool-water carbonate-producing organisms during a cold period in the Plio-Pleistocene.

Preliminary laboratory analyses on the Favignana calcarenites indicate very high porosities reaching up to 50-60%, likely preserved due to the low degree of post-depositional cementation and compaction. Facies 1 sediments, overall indicating a lower degree of depositional energy, tend to yield greater porosity values. Further research will focus on the 3D facies distribution and the relation of facies versus porosity and permeability.