



Paleoenvironments in the Roman Claudius Harbour at the Tiber River Mouth (Central Italy). Evidences from benthic foraminifera.

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During a subsurface survey performed in the Tiber River delta plain by ANAS (the Italian Agency for the Roads) in 2004 by means of several drillings, the recovery of Roman remains gave new evidences of ancient structures referable to the well-known Emperor Claudius harbour. The harbour was built by Emperor Claudius between 41 and 54 AD and successively widened by Emperor Traianus between 100 and 106 AD. It was constituted by a 0.9 km² wide dock, partly excavated on the land, delimited in the North and in the South by two long piers and protected at the inlet by an artificial lighthouse island. Due to the unfavourable exposition of the harbour to the storms, that determined the sinking of many ships, Emperor Traianus built a new inner hexagonal basin. The proximity of the river mouth and a northward long-shore current determined a high sediments supply to the harbour that needed frequent dredging. The commercial shipping gradually decreased after the fall of the Roman Empire and the harbour basin was definitively filled up by sediments due to the delta plain progradation, that started in the XV century.

Quantitative analyses on benthic foraminiferal assemblages from eight cores, have been performed for paleoenvironmental reconstruction of distinct harbour sectors.

Benthic foraminifera are recognised to be highly sensitive to environmental changes due to both natural and man-induced factors in marine and transitional environments, and have been successfully already used in geoarchaeological studies of harbours (Reinhardt et al., 1994). They are particularly suitable for paleoenvironmental studies from drillings because they give the record of temporal changes, attributable, in our

case, to the historical evolution of the harbour. In addition, small samples may contain a high number of test, that allow the statistical analysis of quantitative results. The availability of eight cores, five of which disposed along a transect, offer the possibility to study coeval spatial variability of paleoenvironments.

A lagoonal assemblage, dominated by *Ammonia parkinsoniana* and *A. tepida*, typical of estuarine areas, has been recognised before the harbour construction. Successively, different environments have been recognised in the harbour area: the first one is characterised by a typical marine infralittoral assemblage (*Ammonia* spp., *Elphidium* spp. and Miliolidae) and is referable to a well-oxygenated infralittoral marine environment located in the area near the inlet and the outer part of the harbour (cores 6, 9B, 8B, 7B). A very shallow water environment (cores 5 and 4) with scarce circulation and low oxygen content, referable to the inner part of the harbour, is testified by significant percentages of *Bulimina* spp. and *Bolivina* spp., associated to abundant *Ammonia* spp. and *Elphidium* spp. A sandy bar that constituted the natural base of a pier is identified in the northern sector of the harbour (cores 11 and 12). After the harbour buria, a continental environment developed in the inner part, while in the outer one a marine infralittoral environment persisted (cores 6 and 5).

Reinhardt E.G., Patterson R.T., Sröder-Adams J., 1994. Geoarchaeology of the ancient harbour site of Cesarea Maritima, Israel: evidence from sedimentology and paleoecology of benthic foraminifera. *J. Foraminiferal Res.* 24 (1), 37-48.