Geophysical Research Abstracts
Vol. 14, EGU2012-10219, 2012
EGU General Assembly 2012

Archeological glass from the Ciutadella de Roses site (Empordà, Girona, NE Spain): chemical characterization

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The town of Roses is placed in the homonymous bay some 15 km north of the greek-roman city of Emporium, in the Empordà Country (Catalonia, NE Spain). The north sector of the Empordà constitutes a fertile river plain located within the Pyrenees Range and the Montgrí calcareous block that has been extensively occupied at least since Neolitic times. The Roses fortress is a space of more than 130.000 m2 of renaissance style built in 1543 that constitutes one of the rare fort places preserved in Catalonia after the Succession War (1701-1714).

The archaeological excavations conducted in the area of the Ciutadella have shown the rests of the Greek city of Rhode, founded at 776 B.C. by Rhodian people; the Hellenistic quartier (especially important at IV-III centuries B.C.; a roman villa (occupied between centuries II B.C. and VI D.C.); a romain-lombard monastery (Santa Maria, century XI), and a series of rests till century XIX.

The excavations conducted in the period 1993-1996 provided glass remnants of several ages in a number of strata at several places within the Ciutadella walls. A number of 25 samples were chosen and cleaned in order to characterize its main chemistry by EMPA. Samples were mounted on a epoxy resin, cut and polished, and external sectors with surface alteration were avoided during analysis. The major constituents Si, Al, Na, K, Fe, Mn, Ca, Mg, Ti and P were analysed, as well as a number of trace elements (metals) that give indication on the colour of glass: Co, Cu, Cr, Sb and Pb. The archaeological data allow dating the concerned strata in several periods: end of VI century-beginning of VII (3 samples) and from middle XVI century to XVIII century. The scope of this work is to provide a first characterization of the glass chemical composition variation along time since late roman times in a near to permanent occupied site.

All the studied glass fragments show a sodic-lime composition, being the ones corresponding to VI-VII of low magnesia and potassium content (and therefore of roman tradition and produced with natron). The composition of these early medieval glass is very close to other reported in other roman archaeological sites of Catalonia (Barcelona downtown city -Barcino-, Tortosa, and so on), and therefore near in composition (but not exactly identical) to the "Levantine I" group of roman glass (i.e. when plotted in a CaO vs $Al2O_3$ diagram). In any case there is not a great number of samples studied (not at Ciutadella de Roses, not in Catalonia) and in absence of a more consistent statistic database is too risky infer more consequences from these results.

On other hand, the rest of the glass can be interpreted as the product of fusion of silica sands with a flux of vegetal origin (ash of halophytic plants, widespread in the marsh sector of Roses bay (today preserved as a Natural Park) except one sample that corresponds again to roman-like glass probably arrived accidentally to the strata of sampling, a fact normal in a space that has been submitted repeatedly to excavation during the time of occupation (i.e. sanitary conducts and pits).

The roman glass is not very interesting in terms of colour; while in the rest of glass a number of colour characters can be noted. Two glass fragments of blue and greenish-blue colour take this pigmentation due to the presence of little amounts of cobalt. Another greenish-blue colour glass fragment is due to the coexistence of high contents of iron and copper (a well-known colour recipe since –at least- XIII century). Finally, a greenish-blue sample of glass does not provide any evidence of the origin of colour, taking into account the analysed elements. A yellowish colored fragment can be interpreted as the result of the presence of iron and copper, probably fused in a kiln under reductive atmosphere. The rest of samples are uncolored and therefore are coherent with the absence

of metals in the reported analysis of glass.

This study has been developed in the framework of Research Consolidated Groups 2009SGR-0044 and 2009SGR-0972 AGAUR/DURSI, Generalitat de Catalunya. We express our acknowledgement to the technical support of the Scientific-Technical Service Unit of the University of Barcelona, and to the Municipality of Roses by kind access to the samples.