



A heavy metals record from the ancient northern harbor of Tyre (Lebanon)

A. Elmaleh (1), A. Galy (2), J.A. Day (2), N. Marriner (3), C. Morhange (3)

(1) Institut de Minéralogie et de Physique des Milieux Condensés, Campus Boucicaut, 140 rue de Lourmel, 75015 Paris (agnes.elmaleh@impmc.jussieu.fr), (2) Department of Earth Sciences, University of Cambridge, Downing Street, Cambridge CB2 3EQ, UK (albert00@esc.cam.ac.uk), (3) Centre Européen de Recherche et d'Enseignement des Géosciences de l'Environnement, Europôle de l'Arbois, BP 80, 13545 Aix-en-Provence (nick.marriner@wanadoo.fr)

We have measured by ICP-MS heavy metals concentrations (Pb, Cu, Zn, As, Sn, Sb..) in a sedimentary core taken in the ancient northern harbor of Tyre (Lebanon). Harbor sediments are important archives of the human activities that took place upstream. The present sequence, which begins at about 6300 BC, offers an opportunity to characterize the use or transformation of metals in Tyre over centuries. Tyre was indeed founded in 2750 BC, according to ancient texts, then reached its apogee during the early iron age (it is one of the major Phoenician city-state), and remained a flourishing city up to Byzantine times. Previous bio-sedimentological studies revealed the existence of major phases of harbor works. Fine temporal fluctuations cannot therefore be reconstructed because of repeated dredging procedures. However, radiocarbon dates allow us to study trends in metal work / use in the city through time. Our results suggest that the anthropogenic pollution started from at least Phoenician times. Maximum metal enrichments are measured in Byzantine sediments, whereas minimum values characterize the Hellenistic period. Elemental ratios are also contrasted from a period to the other. Sn/Cu ratios suggest a signature of typical antique tin bronze (Cu and Sn alloy) during the Hellenistic period. Both Sn/Cu and Pb/Cu ratios suggest an increased use of lead and possibly pewter (Pb and Sn alloy) during Roman and Byzantine periods. The decline of metal enrichment at the end of the Byzantine times geochemical evidence for the economic demise of Tyre at this period. As a perspective, lead isotope measurements would help to better constrain the source of the heavy metal pollution of Tyre harbor sediments, in particular the provenance of the metal ores.