The intertidal sanding up of the Seine-Maritime coast (Normandy, France): Sedimentological and geochemical approaches.

Bastien Peuziat¹,², Stéphane Costa¹, Bernadette Tessier², Anne Murat³,⁴, and Gwendoline Gregoire³,⁴

¹Normandie Univ, UNICAEN, CNRS, LETG, 14000 Caen, France
²Normandie Univ, UNICAEN, CNRS, M2C, 14000 Caen, France
³Conservatoire National des Arts et Métiers, INTECHMER, 50100 Cherbourg, France
⁴Normandie Univ, UNICAEN, Laboratoire des Sciences Appliquées de Cherbourg, EA 4253, 50100 Cherbourg, France

The Seine-Maritime coastline (France) is a macro-tidal environment (8 m tidal range), developing along an epicontinental sea, the English Channel. The SW-NE coast is opened to westerly atmospheric flows, generating occasionally wind sea with energetic waves (Hs: 4.65 m decennial return). High chalk cliffs and a wide marine erosion platform partially hidden on its upper part by a flint pebble beach, characterise this 130 km long coast.

Observations since the end of the 1990's show a recent and massive sanding up of the marine erosion platform. This raises the question of the origin of the sandy fraction and the sedimentary dynamics on the intertidal area.

We present herein an innovative method that combine grain-size and geochemical analysis in order to highlight sand sources and transport direction along these rocky coast.

Sixteen beaches were sampled during low tide and fair-weather conditions. At each site, 3 samples were collected along the cross-shore beach profile (from the pebbly upper beach to the low tide limit).

Grain-size results show that for all sites, medium to coarse-grained sands dominate in the upper beach (mode 315-400µm) while fine sands dominate in the middle and low foreshore (mode 160-250µm). A decrease in grain-size is thus evidenced from the upper beach to the low foreshore.

The geographical variability of the sand composition and consequently sources was determined on the basis of geochemical data. In order to avoid the granulometric effect on the data, X-Ray fluorescence analysis (XSORT, SPECTRO AMETEK) were performed on the two major grain-size modes of each sample. Eighteen calibrated chemical elements (Si, S, K, Ca, Ti, V, Mn, Fe, Ni, Ga, As, Br, Rb, Sr, Y, Pb, Th and U) were measured at each station. Statistical processing performed step by step on the data allows to gradually reduce the number of significant geochemical parameters. Finally, 4 major elements (Si, Ca, Sr, K) as well as the ratio Sr/Ca have been considered as the best proxies of sample discrimination and potential source.
The first results indicate a longshore gradient of Si and Ca, especially for the finest sands (160-200µm). From SW to NE, i.e. in the direction of the littoral drift, and whatever the position across the beach profile, there are an enrichment in Si (sands are more siliciclastic) and an impoverishment in Ca.

This gradient highlights differentiated longshore sediment transport and sorting, in relation probably with sediment sources (siliclastic sands vs bioclastics sands).