Isotopic variations in the recent sediments of the Caspian Sea: a record of Quaternary continental weathering?

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The region of the Caspian Sea was subjected to important climatic and sea-level changes during the Quaternary. The precise causes of these changes are not well deciphered yet. Many factors like climate change, human impact, solar activity, hydrothermal and tectonic events, and their complex combinations have been supposed to influence CS levels.

This study presents combined mineralogical, chemical and isotopic ($^{87}Sr/^{86}Sr$ and U-Th disequilibria series) analyses on bulk sediments and on distinct mineral phases (carbonates and clays) from a 10-m-long core drilled in the the southern Caspian Sea and containing Late Pleistocene and Holocene records.

The main topics of this study are a 1) geochemical identification of the sedimentary variations in a long core from the Caspian Sea, 2) an identification of the parameters having induced these variations and, 3) the influence of the main climatic and/or Caspian Sea level changes in the region since the Last Glacial Maximum. In order to trace the contribution sources and the processes, we have combined mineralogical, chemical, and isotopic (Sr isotopic, REE and U/Th radioactive disequilibria) analyses, on bulk sediments and on different mineral phases. The study of the different phases allowed us to differentiate the carbonate/silicate and/or biogenic/detrital sedimentation process.

The chemical and mineralogical results allowed the division of the sedimentary sequence into three main units and a transition zone.

The lower unit U1 consists mainly in silicate and carbonate-rich detrital materials. The sedimentation is relatively constant along U1 and the detrital fractions correspond to material in secular equilibrium, resulting from mechanical erosion in cold climate. This unit corresponds probably to the Khvalynian Transgression, which is the main transgression in the Caspian Sea during the Late Pleistocene-Holocene period.

The global increase of temperatures and the decrease of sea level have completely modified the sedimentation in the Caspian Sea. Our study shows that these changes have induced a higher

biogenic sedimentation in U2 and U3, and a clearly different detrital sedimentation than in the U1 unit. The differences in detrital input could be explained by a decrease of aeolian contribution and by modification in the configuration of the catchment area of the Caspian Sea. The study of the bulk sediments, clays and carbonates reflect an increase of chemical weathering since about 10 ka BP.

Our results suggest then an evolution of the continental weathering conditions in the drainage basin of the Caspian Sea from mechanical/physical erosion during the cold LMG period to a continuous increase of weathering since about 10,000 yr, which illustrates the strong relation between climate and weathering processes.