



## Recent pollutant history of the KaraBogaz-Gol - Caspian Sea ecosystem (Rep. of Turkmenistan)

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High-resolution laminated lacustrine sediments are excellent archives of the past environmental and anthropogenic processes and they provide valuable insights about the mechanisms that trigger these processes. The multidisciplinary study (petrography, x-ray diffractions, elemental geochemistry (major, minor and trace elements determined by ICP-OES and ICP-MS, respectively) and a robust chronological framework ( $^{210}\text{Pb}$ ,  $^{137}\text{Cs}$ ,  $^{226}\text{Ra}$ ,  $^{241}\text{Am}$  and plutonium)) of the uppermost meter of the KaraBogaz-Gol (KBG) sedimentary infill (the hypersaline terminal bay located at the eastern side of the Caspian Sea ecosystem - 41° 50' N - 53° 10' E, -28 m b.B.S. (below Baltic Sea)) have allowed us to characterize the evolution of the natural environmental oscillations and the different anthropogenic impacts that occurred in the lacustrine and Volga catchment ecosystems over the last 200 years.

The KBG sediments are made up of a centimetric to decimetric alternation of dark grayish siliciclastic silty-clay and gypsumiferous light sandy layers, with some intercalations of whitish layers of salt and several levels rich in *Cerastoderma* sp. shells. The mineralogical composition of the sediments allowed us to quantitatively reconstruct the lake level evolution for the studied period.

The construction of the chronological model has been rather difficult owing to large sedimentation rate. The massive gypsum accumulation that took place during the low lake level periods provoked the "dilution" of the  $^{210}\text{Pb}$ . Therefore, the chronological model has been built only using the most "terrigenous" samples.

A number of chemical contaminant elements have been identified (P, Cd, Sb, Bi, Se, Th, V, Cr, Mo, U and As) and they do not present a common behaviour. The statistical treatment (Redundant Analyses) of the mineralogical composition and of the contaminant geochemical data permitted to identify the sedimentary input processes (fluvial and eolian terrigenous, and endogenic particles), and thus the input mechanisms of the contaminants (adsorbed to the fluvial and/or eolian terrigenous particles, dissolved in the water and later fixed by the endogenic minerals, ...). Furthermore, the contaminant concentration within the sediments largely varies through time and most of these contaminants are strongly triggered by past lake level oscillations. During the high lake level periods (prior 1810 - 1854 AD and 1898 - 1940 AD) a number of contaminant elements (P, Cr, V, Se, Mo, Bi and As) display their highest values, and inversely. Other pollutants (Cd and Sb) does not show this relationship. From 1970 to 1985 AD, there is a general increase trend in all pollutants peaking during the mid 1980s. From this date onwards, the concentration of pollutants slightly decreases, probably due to the different environmental remediation measures applied in order to preserve the Caspian Sea - KaraBogaz Gol ecosystems.

On the other hand, radioactive contaminant elements, such as Pu and  $^{137}\text{Cs}$ , accurately show the recent nuclear history of this area. Plutonium shows its largest peak during the early 1960s, when the Soviet Union carried the largest number of nuclear weapon tests, whereas  $^{137}\text{Cs}$  displays its maximum concentration during mid 1980s, probably due to Chernobyl disaster.